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Rt. Hon. K. J. Holyoake,
Minister of Agriculture

This Month's Cover

An autumn scene in the district between Arrowtown and Queenstown in Central Otago is the subject of this month's cover, which has been reproduced from a colour photograph by National Publicity Studios. Production in the area is limited by the low rainfall, and extensive sheep farming mainly is practised. There are, however, small pockets that are fairly intensively farmed and on them grass, clover, and brassica seed crops are frequently grown. Some parts of the district can obtain water for irrigation and it is common for the water to be channelled through irrigation ditches constructed by the gold miners who flocked to the Arrowtown district from the 1860s.

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Young Farmers' Clubs Movement is 21 this Month

TWENTY-ONE years ago this month the New Zealand Federation of Young Farmers' Clubs was founded in Otago. While attaining its majority the federation has grown from a small experiment in agricultural education to become a Dominion-wide movement that has served New Zealand farming well.

Many of our finest institutions were conceived in times of adversity. When the Y.F.C. movement was started those without the necessary faith and vision might have thought that the times were not propitious for the launching of a new, untried mode of spreading agricultural knowledge. It was during the depression of the early 1930s that a small group saw the need for an organisation to cater for the young men of the farming community. They had the courage to initiate the Young Farmers' Clubs movement and the enthusiasm to sustain it through its early difficulties. Mr. J. E. Davies, an Instructor in Agriculture of the Department of Agriculture who was working with Boys' and Girls' Agricultural Clubs in Otago, saw the possibility of extending the work to older groups in 1933. Under the guidance of Mr. R. B. Tennent, then Fields Superintendent, Dunedin, and now Assistant Director-General of Agriculture, Mr. Davies formed experimental Young Farmers' Clubs at Palmerston, Dunback, and Five Forks. The clubs were for young men between the ages of 14 and 25 years, later raised to 30 years. Mr. A. C. Cameron, general manager of the Otago Farmers' Union Mutual Fire Insurance Association, became interested and gave much assistance personally and through his staff.

As a result of an educational week at Dunedin organised by Mr. Cameron in June 1933 attended by 100 selected youths more clubs were formed in the region. In March 1934 the federation was formed with 8 clubs. The history of the Y.F.C. movement cannot be recorded in detail here. Its growth to its present strength of 350 clubs and 10,000 members has been the outcome of the enthusiasm of the young men themselves, the early sponsors, agricultural educationists in the service of the State and agricultural and research foundations, farmers, and trading firms.

At the outbreak of war in 1939 there were 203 Young Farmers' Clubs throughout New Zealand. Because many members joined the forces and others were working long hours on war production, most of these clubs had to go into recess. Over 3000 members served in the armed forces and at least 200 lost their lives. Their service and sacrifice are commemorated at Massey and Canterbury Agricultural Colleges by fine buildings provided by the federation and containing residential, study, or recreational facilities for Young Farmers taking the special short courses in agriculture and related subjects at the two agricultural colleges. The provision of sites within the colleges' grounds for these buildings is indicative of the continued practical interest the colleges have shown in the movement and the emphasis that has always been placed on the importance of agricultural education in the activities of clubs.

The Young Farmers' Clubs movement is now an integral part of the rural scene. Farmers of all ages are to be found at lectures and demonstrations on a wide variety of farm topics organised by local clubs. The federation will have served posterity well if it can preserve the good neighbour outlook which has been such a strong feature of the farming community since the pioneer days. The organisation has reached man's estate, but long before this it was doing a man's job for the community. The problems of the future promise to be no less complex than those of today, but I think they will be in good hands. The history of European settlement in New Zealand is brief, but it is rich in high endeavour and the conquest of difficulties which at the time seemed insuperable.

The older farmers should realise that they have in their midst an organisation of proved value which well deserves their support. That many of them fully appreciate the benefits of the clubs not only to the young men themselves but to primary industry is shown by the splendid record of service of many older farmers as advisory members to clubs.

I would say to farmers when the question of sons or young employees attending Y.F.C. functions arises: Stretch a point and let them go. I am sure that it will repay you a hundredfold. I am sure that clubs are grateful to farmers for their many forms of help.

To the Young Farmers of New Zealand I say this: You have every reason to be proud of the accomplishments of your organisation in your first 21 years. Do not rest on your laurels. Continue to build on the solid foundations that have been laid. You have a great heritage and New Zealand, I am convinced, is on the threshold of a great new era of agricultural expansion in which you will be called on to play a leading part.

The Department of Agriculture can take some pride in the part it has played in founding and fostering the Y.F.C. movement. The Government is glad to provide facilities, funds, and the services of officers of the Department, for it is convinced that the work of the movement is of lasting benefit to the country. The help does not all go one way, however, for the Y.F.C. federation has organised large rural gatherings at which the Department of Agriculture has been able to further its extension work in many ways. The Y.F.C. federation, of course, manages its own affairs, and I have been very much impressed by the calibre of the young leaders that the movement has produced.

I congratulate the federation on reaching its majority and extend my best wishes for its future success.

K. J. HOLYOAKE, Minister of Agriculture

Winter Rotation of Dry Stock on the Dairy Farm

By E. M. BATES, Instructor in Agriculture, Department of Agriculture, Hawera

AS the dairying season draws to a close it becomes necessary for the farmer to make adequate plans and provision not only for the approaching dry season, but for the early portion of the following lactation period. Success or failure of the next dairy season depends to a very large extent on how efficient his planning and the carrying out of his planning have been.

DURING autumn ample time is usually available for attention to be paid to two essential prerequisites for the efficient operation of the farm as a self-contained business unit:—

1. Adequate subdivision.

2. Provision of winter-grown pasture for early spring use.

It has been found in practice that not fewer than 16 paddocks are necessary for making the fullest use of the land. Area, shape, and topography have to be taken into consideration in planning the subdivision of any farm property, but experience on many different types of dairy farms has shown that permanent subdivisions giving not fewer than 16 paddocks have resulted in maximum workability and production. On many farms there are one or more very large paddocks that could be conveniently and often cheaply cut in two. Whether further subdivision, if necessary, can be tackled as an immediate project or whether it has to be relegated to a place in the long-term development of the property, provision of adequate supplies of high-quality pasture for the early calving cows cannot be neglected.

The time of closing pastures for winter growth and the area to be closed vary from locality to locality, and even from farm to farm. At the Waimate West Demonstration Farm, Manaia, where observations over a number of years have been made, it has been found that closing about one-fourth of the farm between the middle and end of May for break grazing from the last week of July has produced good results. Where first calvings are due earlier than mid-July and in colder localities, where winter growth is more retarded, earlier closing would be essential.

It should, of course, be stressed that with the exception of any area laid down early in the same autumn the more recently sown pastures consisting of high-grade, vigorous, and quick-growing strains of grasses and clovers should be used. These are less liable to contain much weed or inferior grasses and will provide a great bulk of edible feed in spring. Old and run-out pastures, such as those containing much Yorkshire fog, should not be used if they can be avoided, and pastures containing much cocksfoot are better used for winter grazing in localities where frosts are to be expected.

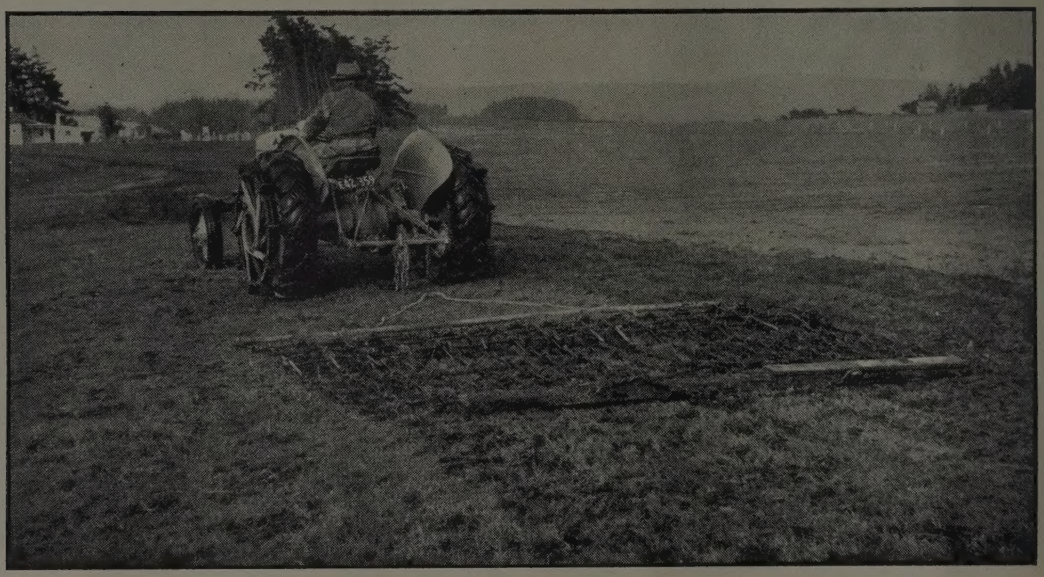
When the paddocks to be used for spring break grazing have been decided on they should be grazed, chain harrowed, and secured against the entry of stock. It should then be possible to plan the movements of the dry stock round the remainder of the farm during winter.

That such a rotation should be deemed a necessity is conceded by most progressive farmers, but there are still too many who for reasons of expediency restrict their dry stock movements to a few paddocks. There are many others who do so under the impression that a long winter spell is needed to promote vigorous grass growth over most of the farm. These latter are unfortunately defeating the very purpose they seek to achieve.

Advantages of Planned Rotation

The advantages gained by planned rotation of dry stock over as much of the farm as soil moisture conditions will allow may be catalogued briefly as follows:—

1. Even hoof cultivation is assured without overtrampling by high stock concentrations during short periods of grazing.
2. Pastures are maintained in a sufficiently open, vigorous state and not allowed to become tight, dense swards of low productive ability.
3. Rough feed left as a residue of the dairying season is eliminated.



Pastures should be chain harrowed to spread dung and inedible feeding stuffs immediately after removal of stock.

4. A bite of fresh feed is made available periodically to the dry stock.
5. Uniformity of pasture species over the paddocks so treated can eventually be attained.
6. Weeds and undesirable pasture species such as Yorkshire fog can be hardest hit by heavy, short-term stock concentration during winter, when they are most susceptible to stock damage.
7. Sufficient spelling between grazings allows for plant recovery and growth.
8. With the feeding out of hay, silage, roots, etc., heavy dressings of animal manure are applied to each paddock in turn. This not only promotes plant growth but stimulates worm and bacterial activity below the surface enormously.

Nobody would contest the need for planned manipulation of cattle round the farm during the milking season to achieve high per-acre production, but the use of dry stock during winter for the same purpose is not so readily perceived, because it is not so obvious. Dairy production by winter stimulation of pastures is an indirect process, but little thought should be necessary to realise the advantages of it.

The Method

It is difficult to lay down hard-and-fast rules governing the winter rotation, as circumstances vary greatly from farm to farm. Such factors as terrain, availability of supplementary feeding stuffs, access, and layout must all be considered. Even under the most adverse circumstances, however, some degree of rotation can be practised and great benefit can be derived from it. The general principles of the rotation can be modified to suit the special circumstances of any particular case.

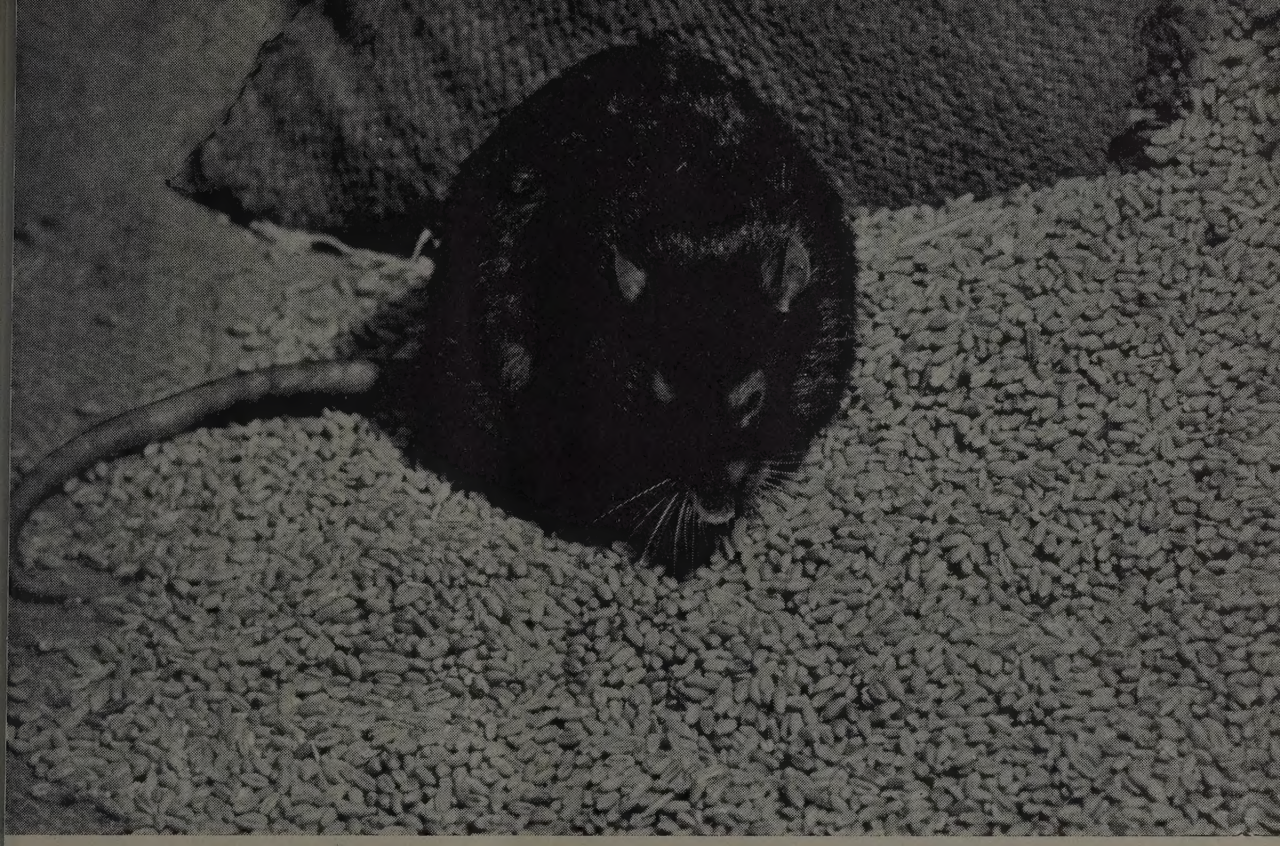
At the Waimate West Demonstration Farm a rigid winter rotation has been carried out for several years, and a marked uniformity of sward over the whole of the farm has been the result. Dry stock are concentrated for up to a week in each paddock available for winter grazing. The principle is to stock each paddock at monthly intervals on light land or longer on heavier land. Adequate quantities of hay and silage are fed in each paddock and the areas are chain harrowed to spread dung and inedible feeding stuffs immediately after the removal of the animals. The harrowing ensures that the residues, which are over 1 ton per acre, are broken up and distributed over the area so that weathering can become immediately effective and the animal fertiliser be available as plant food within about 10 days.

To avoid unduly pugging the newer and better pastures during and after periods of heavy rainfall it has been found advantageous to move the stock to a paddock that is shortly to be ploughed. To prevent the animals from standing round gateways during stormy weather an electric fence may be erected at some distance inside the paddock.

Such a rotation has ensured that each of the grazing paddocks received the treatment two or three times during winter. Spelling of between 30 and 60 days (depending on the length of time the stock are concentrated in each) is ensured for the paddocks. Provision is thus made for ample pasture stimulation without undue punishment.

As spring calvings begin and the number of dry cows diminishes the length of time the dwindling number may be held in one paddock may be proportionately increased. The freshly calved cows are break fed on autumn-saved pastures, and as each is eaten off the dry cattle come after them as followers to clean up any rough feed that may be left. Thus at this stage all the winter-grazed pastures have been closed to stock and provide supplies of young, fresh grass, which is available for the use of the milking cows when the winter-grown pastures have been exhausted.

The operation of such a scheme, even modified to suit individual requirements, should present little difficulty. The manifest advantages more than offset the small amount of additional work involved on the majority of farms. The farmer attempting it for the first time has to be certain of only three items: To ensure that adequate supplies of supplementary feed are made available for the stock; to harrow immediately after removal of stock from a paddock, which should be of a workable size; and to guard against too severe pugging in wet weather or on low-lying land.



The Control of Rats and Mice

NO accurate assessment of New Zealand's rat population has ever been made, but data available make it obvious that the depredations of rats represent a national economic waste that could be cut down with concerted and continuing efforts. In this article I. G. McIntosh, Toxicologist, Department of Agriculture Animal Research Station, Wallaceville, and T. W. Adams, Senior Inspector of Health, Department of Health, Wellington, discuss the effect on public health of rat and mouse infestations and the economic loss they cause and describe how control of rats and mice can be effected by the use of poisons, by rat proofing, and by the destruction of harbourage for the pests.

LIKE all other civilised countries, New Zealand harbours an unwelcome rat and mouse population. These pests eat and spoil all types of food intended for human and animal consumption, destroy packages, sacks and fabrics of all kinds, damage buildings and furniture, and carry diseases that affect man; rats have been known to bite and injure babies. At present, through ignorance and apathy, rat control is desultory and ineffective in the greater part of the country.

Effect on Public Health

Plague or the black death as it was known in the Middle Ages and murine typhus have been responsible for millions of deaths in the world during the present century. These diseases are transmitted to man from infected rats through the agency of fleas.

The first authentic case of plague was diagnosed in New Zealand in 1900, and thereafter at intervals of a year or two cases were reported until 1911. In all 21 cases occurred, with 9 deaths, mostly in the Auckland district. It was not established whether infected rats were present in the country throughout this period, but it is reasonably certain that infected rats have landed in New Zealand from time to time, but have not met conditions favourable to the spread of plague.

The incidence of plague is being steadily lowered in the older countries and the enforcement of the International Sanitary Regulations of the World Health Organization should provide an effective barrier to the future introduction to New Zealand of both plague and murine typhus. In view of the large rat populations that have existed at some of the main ports in this country New Zealand has been very fortunate in the past in avoiding more serious spread of disease.

In recent years attention has been given to the part played by rats on the incidence of other serious illnesses in man. Salmonellosis and Weil's disease are two that deserve mention. Salmonellosis occurs also in animals, and recent studies have shown that New Zealand rats carry the causal organism, which has been identified in numerous cases of food poisoning. Though commonly spread by food contaminated by the droppings of infected rats, salmonellosis is not necessarily classed as food poisoning, as it can be contracted by contact with animals in a variety of ways.

HEADING PHOTOGRAPH: As a rat eats an ounce of wheat or its equivalent in other foods each day, 100 rats will eat 1 ton in a year.

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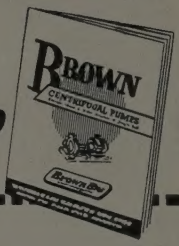

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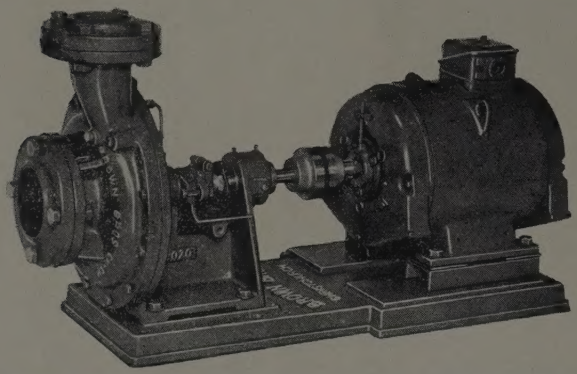

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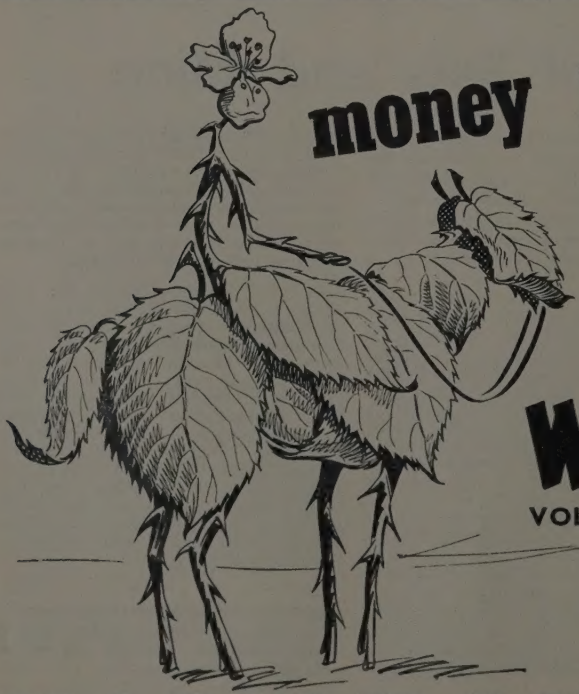

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The disease as distinct from food poisoning was first made notifiable in 1952 and by the end of the following year 140 human cases had been reported. In stock also the disease is being diagnosed more frequently, and since the relationship of rats to salmonellosis is proven, the suppression of rats on farms as well as urban areas becomes increasingly important.

Weil's disease is caused by a *leptospira* related to but differing from the one which commonly causes disease in cattle and pigs in New Zealand and which also affects man. Though rats are the natural hosts of the type causing Weil's disease, they are little affected by it, but frequently excrete the organism in their urine, thus contaminating food or water subsequently consumed by man. Pigs can become infected and constitute a potential danger to farm workers.

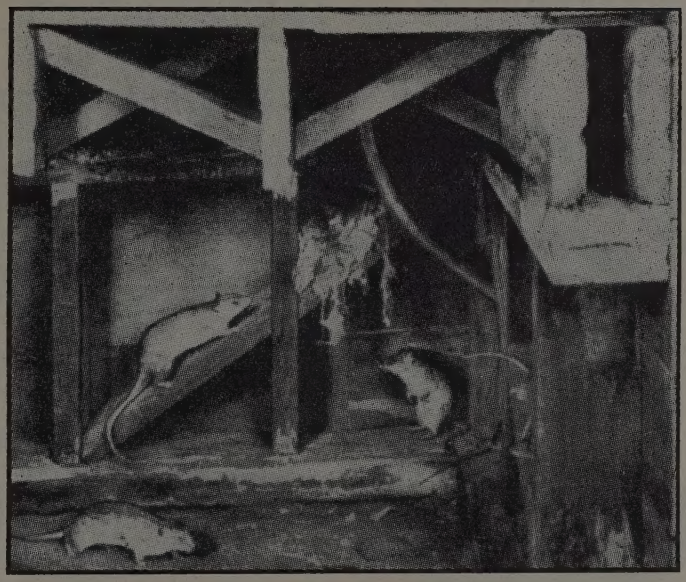
The infection was first discovered in rats in New Zealand in 1950 and the first human case was reported in the Annual Report of the Director-General of Health for 1952. How the patient picked up the infection is not definitely established, but just before his illness he shifted some timber from a stagnant pool adjacent to a pig sty where rats were numerous and could have contaminated the water with urine. The related organism has caused 165 human cases of leptospirosis up to March 1954, but rats cannot be incriminated, since the causal organism has not been discovered in these pests in New Zealand.

Apart from being carriers of specific diseases rats frequent drains, fowlhouses, pig sties, and garbage tips and carry the filth from these on their bodies to contaminate foodstuffs in kitchens, restaurants, and food premises. They urinate indiscriminately and faecal pellets are found even in their own food. There is no doubt that many other diseases with indefinite symptoms and which are classed as "flu" or "summer sickness" could also be caused by rats. It is impossible to estimate accurately the amount of human suffering which may be attributed to rats, but the several hundred reported cases of the diseases mentioned which occur every year in New Zealand provide sufficient evidence that a large rat population is a serious menace to health.

Economic Aspects

Rat-borne diseases transmitted to man cause a loss of working time and a lowering of national production. By far the greatest loss is caused, however, by the eating and spoiling of human and animal food and damage to packages, containers, and fabrics. Most authorities agree that a rat will eat an ounce of wheat a day or its equivalent in other foods. For a hundred rats this means that their annual food consumption is a ton.

Middleton in 1948 stated in regard to British farms: "Even today, after years of expensive control, there are very few arable farms which support less than a hundred rats, and there is no doubt that on many the rat population is easier to measure in thousands".



A large rat population is a menace to public health. Apart from being carriers of specific diseases rats can cause many other diseases with indefinite symptoms such as "flu" and "summer sickness".

Gunderson stated in 1943 that for Iowa farms the number of rats can be roughly assessed as follows:—

If none seen, 0 to 20 are present.

If occasionally seen, 20 to 200 are present.

If often seen, more than 200 are present.

On New Zealand farms where active control measures have been undertaken it has been found that the farmers' estimates of rat populations have always been grossly low. When one considers the figures quoted by Wodzicki in 1949 for rats caught annually in Auckland City (about 7000, exclusive of "Rat Week") and for rats caught by a rat catcher in Nelson in 1945 (8000 in 11 months) after a heavy infestation, it becomes obvious that the country's rat population must number millions, though a great many live in the bush and cause no food wastage. Even if only a million rats were feeding on grain and other human and animal foodstuffs, the annual wastage and spoilage would run into many hundreds of thousands of pounds.

Present Control Measures

In New Zealand the occupier of any premises is legally responsible for the destruction and suppression of rats. Where conditions which provide harbourage for rats or favour breeding are permitted an offence under the provisions of the Health Act is committed. Apart from the question of self-defence on hygienic or economic grounds any law-abiding citizen is thus obliged to adopt control measures. Sanitary inspectors of borough or city councils are always available to give advice on how to deal with an infestation. City councils usually distribute poisons and some provide the services of a special rodent control officer. Apart from the free advice given by these services there are several commercial firms engaged in pest control work in most cities. No one need hesitate to obtain the assistance of officers of the local authorities, as they always regard any rat infestation as important, no matter how trivial it may appear to the occupier. One rat in any premises is one too many.

Generally attempts at rat catching by private individuals are carried out in a half-hearted fashion. Some people are content merely to set a trap or throw down a few poison baits occasionally. Often rats will not eat the poisoned baits and it has been shown by laboratory tests at Wallaceville that some commercial rat "poisons" on the market have not been poisonous to rats. The reasons for failure to eat poisoned baits will be dealt with later. Others feel that by keeping a cat they are doing a really good job, and of course many people make no attempt to kill rats.

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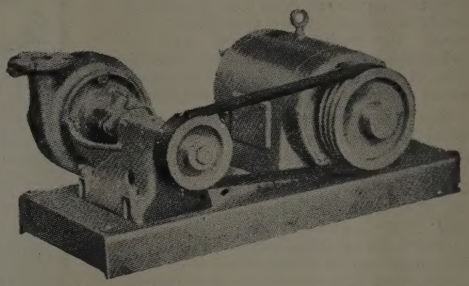

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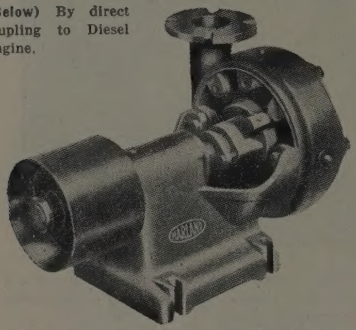

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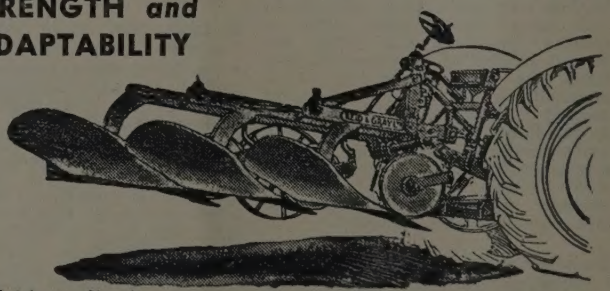

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Occasionally the owner of a food shop or other business premises is persuaded to make a conscientious effort and a number of rats are killed, but too often when rats continue to come in from neighbouring premises he becomes discouraged and gives up the attempt. With such haphazard control methods the rat population is bound to increase up to the natural equilibrium which is governed mainly by available food supply and harbourage where they can breed undisturbed. Rats are extremely prolific, starting to produce annually 3 to 5 litters of perhaps 7 young from about 3 months of age.

It is certain that complete eradication of rats will never be achieved and continuing suppressive measures will be necessary as a matter of routine so that rats are always under control and never allowed to become a problem on any farm or business premises. For success in control measures their persistence and cunning must be matched and there is no question that this can be done if the effort is sustained.

Keeping a dwelling house free from rats and mice is fairly simple if at the first signs of infestation, prompt action is taken to kill the pests and block entry points. On farms and in business premises and factories the task is not so simple, and knowledge, determination, and patience are necessary. The principles of suppression and control are the same everywhere and the amount of effort required is proportional to the extent of infestation.

Habits of Rats and Mice

Before any control measures are considered it is essential to understand the habits of the pest.

The species commonly found in New Zealand are:—

(a) *Rattus rattus*, variously known as the black rat, ship rat, roof rat, or house rat. It is an excellent climber and mostly inhabits buildings where it can climb into ceilings and upper stories. It is commonly found in food premises and restaurants. There is a fairly large population in the main ports and it occurs in inland towns, in native bush and scrub, and in farm buildings, maize cribs, and haystacks. The term black rat is misleading, as it is often brown or grey and may have a white belly.

(b) *Rattus norvegicus*, common brown rat, water rat, or sewer rat. This rat usually grows much larger than the black rat. It is found in sewers, around fowlhouses, maize cribs, on river banks, refuse tips, and in similar places near a food supply where it can burrow and nest underground. The burrows are 2in. to 4in. in diameter, are up to 3ft. below ground, and can be 20ft. in length to the nesting chamber. During non-breeding periods a single burrow may harbour many rats. Brown rats prefer to live in these burrows in the ground, but they also infest buildings, where nests are usually found in holes in basements or on the ground floor.

(c) *Mus musculus* or common house mouse is found everywhere. It is both a burrower and a climber, but ranges over a very limited area. It can manage without water, getting sufficient in its food, and often nests close to a food supply and does not move more than a few yards.

Rats are normally nocturnal in their habits and if they are seen in any number during the day, it can be taken as a clear indication of a major infestation. They tend to be methodical and use the same track when passing between the nest and the food supply. Out of doors the grass or earth is beaten down along the route and in buildings the movement of the rats alongside walls and on pipes can be traced by observing markings or smears made by the dirt and oil on their bodies. The front teeth of rats grow throughout life and much gnawing, with consequent damage, is done to wear down the teeth which would otherwise become excessively long.

Rats move from building to building and are transported with loads of foodstuffs and refuse and at times there are unexplained migratory movements of large numbers over long distances. Once they establish a colony they usually remain within a limited area for a long time.

RECOMMENDED CONTROL METHODS

Recommended methods of controlling rats are destruction of harbourage, rat proofing, making food and water inaccessible to rats, and destruction of the pests.

Rat Harbourage

To breed and so increase in numbers rats must first find a suitable nesting place where they can remain undisturbed for a few weeks. The removal of conditions favourable to rat harbourage is counted among the best and most effective control measures, because natural limitation of rat population comes about mainly through competition among rats for food and harbourage available. The simple act of removing accumulations of refuse and the tidying up of premises is often sufficient to deal with an infestation. A major infestation is seldom found in premises where goods are stacked in an orderly fashion.

Outdoors the brown rat will take cover where there is an accumulation of refuse such as paper, straw, empty boxes, stacks of timber, or disused machinery which may be left in the same place for a few weeks. Only a small space out of sight and reasonably near a supply of food and water is required for a rat to make its home and find warmth and shelter.

Inside buildings rats and mice will nest behind stacks of grain or produce in sacks, in cartons of goods stored for long periods, in open cases containing packing materials, and in all types of odd nooks and crannies which offer protection. A casual inspection of an infested barn or store will usually reveal numerous places suitable for nesting and it is essential that these be cleaned up. Machinery and old junk which is not likely to be used for long periods should be placed so that it can be inspected for signs of rats nesting there.

In grain stores or places where large quantities of food are stored in stacks or boxes the stacks should be kept away from walls and arranged in sections with walkways to permit ready inspection at frequent intervals. The adoption of proper storage methods, the systematic stacking and rotation of stocks, the regular removal of empty sacks and containers, and the prompt disposal of refuse and articles of no value will eliminate dead space and prevent rats from finding nesting places where they can breed and found a colony.

Rat Proofing

Rat proofing is a preventive measure and is the best method of control. There is keen competition among rats for food and harbourage and if they can be prevented from gaining access to buildings and denied shelter, the problem of destruction or suppression does not arise. The first effort should therefore be directed to "building them out". Most new buildings, including dwelling houses, are so constructed as to be rat proof. This is usually achieved by providing concrete foundations and using under-floor ventilators of less than ½in. grid spacing. The rat proofing of existing buildings is sometimes not even contemplated owing to the apparent technical difficulties and probably high cost.

Often a careful inspection will reveal many holes and openings round pipes which can be blocked with cement plaster or by tacking on sheet iron or even pieces cut from old tins. Minor defects in doors, walls, and floors where rats have gnawed through can usually be repaired at small cost and doors and jambs can be protected by fitting a sheet metal plate extending at least 12in. from the bottom, and windows or other openings where rats may gain entrance can be fitted with ½in. mesh netting. Similar netting can be used to proof spaces under eaves.

In old buildings where proofing is not practicable and where some action is necessary because food is stored which is particularly attractive to rats a small rat-proof store can be built

within the building by laying a concrete floor and dwarf walls and erecting a frame covered with ½in. mesh netting, care being taken to see that the door fits snugly and leaves no openings more than ½in. wide.

Rats cannot jump more than 3ft. and cannot scale a smooth surface. An effective rat-proof grain store for larger poultry farms can be made by erecting walls 3ft. high within a building and covering them on the outside with smooth sheet iron. If the floor is of wood, it should be examined regularly for rat holes or alternatively covered with smooth sheet iron. As such a store would be in frequent use, consideration should be given to fitting single or double doors 3ft. high with double swing spring hinges. The doors should also be covered on the outside with smooth sheet iron. Such a store can be stacked to any height with sacks, but care should be taken to prevent rats dropping on to the stored grain from the rafters. This could be easily overcome by nailing sheet iron to the rafters to make a continuous ceiling bigger than the storage bin.

Maize cribs can be protected by erecting them on platforms at least 3ft. off the ground on piles made of drain pipes filled with concrete or on wooden piles sheathed with smooth sheet iron. Wooden piles of sufficient height can also be protected by inverted cones of sheet metal at the tops. These cones should project at least 10in. out from the piles and have a good slope on them.

Though rat proofing may not always be possible, seeking the advice of the local authority regarding what can be done is well worth while, because even if some entry points are blocked, the barrier against rats may be raised sufficiently to discourage rats and prevent a troublesome infestation.

Making Food and Water Inaccessible to Rats

For rats to survive and establish a colony in any place an adequate supply of food and water is essential. Grain is their favourite food, but they will eat practically anything that man eats and, like man, will when sufficiently hard pressed devour their own kind. On the principle of no food no rats, one of the best methods of control is to ensure that all food is inaccessible to them. Where large quantities of grain or produce are to be stored complete rat proofing is essential and this is usually done for economic reasons. The losses caused by rats where smaller quantities of food are stored are not generally realised and it is in these establishments that feeding places are frequently found (100 rats eat 1 ton of wheat per year). The small fowl feed store or any place where fowls or pigs are overfed so that scraps of food or small quantities of grain remain overnight are attractive feeding places. Hoppers for dry mash are a problem and the only way these can be handled is to shut them down at night.

Backyard poultry keepers should realise that fowlhouses provide ideal feeding places for rats which may later invade their homes. Making of fowlhouses completely rat proof should be considered for health and economic reasons. If a run is provided, the trap should be closed at night.

In commercial poultry keeping the chief trouble lies in faulty foundations. Concrete foundations with projecting underground wings of small mesh netting provide a satisfactory deterrent to rats burrowing under the houses. Usually on commercial poultry farms the main colonies are found in or near the grain stores. One or two oil drums with suitable covers could meet the needs of most small poultry keepers for rat-proof receptacles for grain storage, and they can be kept in the fowlhouse.

In work places remnants of lunches support a surprisingly large number of rats and mice unless proper provision for disposal is made. In dwellings food should be stored in properly constructed rat-proof cupboards or in tins or other stout receptacles. Extra care should be taken with food scraps and where these cannot be disposed of immediately by burning, metal refuse tins with tightly fitting lids should be used.

As rats, though not mice, must have access to a water supply, steps should be taken to deny them water. By fitting lids on water closet cisterns, rat proofing water storage tanks, repairing leaking tap washers, and covering fire buckets and other vessels containing water it is generally possible to ensure that no water is available inside buildings where an infestation is known. It is not always simple to achieve complete success in eliminating feeding and watering places, but careful study and thought will often solve these problems and make premises unattractive to rats.

Rat Destruction

If all efforts to discourage or prevent rats from entering premises have failed, the infestation or reinfestation must be dealt with right away, before a colony is established. The method used to destroy the rats must be chosen according to the circumstances and sometimes it may be necessary to use a combination of several methods. A systematic approach and a great deal of patience and persistence are required whatever method of attack is used and for a major infestation or where a difficult problem is presented it is wise to seek expert advice before starting the campaign.

The success or failure of destruction methods is measured by the number of rats remaining after the operation rather than by the number of rats killed. The objective is to rid the premises completely of rats by killing every rat in the shortest possible time, and the operation must cover a sufficiently large area to prevent a reinfestation from adjoining premises. It is little use spending a lot of effort in destroying rats in a building if more can enter continuously and therefore rat proofing of the premises is essential.

Effective Poisoning Most Efficient

For large-scale destruction there is no question that effective poisoning is the most efficient method. In Britain during the war much research was done on the poisoning of rats and valuable data were obtained. Much of the organisation built up during that time has remained and most farm rat control is now in the hands of the County Pest Control Departments working under the supervision of the Ministry of Agriculture and Fisheries. Many of the counties have a pest control staff of 30 or 40 officers and operators, most of whom are concerned mainly with rat destruction. Middleton in 1948 stated: "The standard method found to give the most reliable results in both rural and urban areas is that of poisoning after prebaiting. A lot of rats can be poisoned by putting down suitable poison baits without prebaiting, but it has been amply proved that careful prebaiting is, in the long run, the key to success in rat poisoning".

These findings give some light on the failures experienced in this country where commercial baits have been put out for rats and have not been eaten. The rat is a suspicious creature and will often not touch foods in places other than those in which it is accustomed to feed. Prebaiting with unpoisoned food quickly overcomes this suspicion without causing any "bait shyness" such as happens when a rat obtains a non-fatal dose of poison through eating a small amount of poisoned bait. The prebaiting food must be the same as that used when poison is incorporated.

Rat's Preferences for Bait

A good deal of work has also been done on the relative preferences of the rat for various baits, and a group of research workers give the following list in decreasing order of preference: Raw meat, raw fish, rolled oats, whole wheat, maize meal, bread crumbs, tinned fish, tinned meat, cooked cereals, cheese, meat scrap, powdered milk, fish meal, fresh vegetables, cooked vegetables, and fresh fruits. Middleton states that "two standard baits are used in Britain, one dry and one wet. Ordinary wheat flour with the addition of 10 per cent. of sugar has proved a most effective dry bait while sausage rusk, moistened with about half its own volume of water, forms a simple and attractive wet bait. Sausage rusk is a form of crushed unleavened biscuit, specially

made for mixing in with meat for the manufacture of sausages".

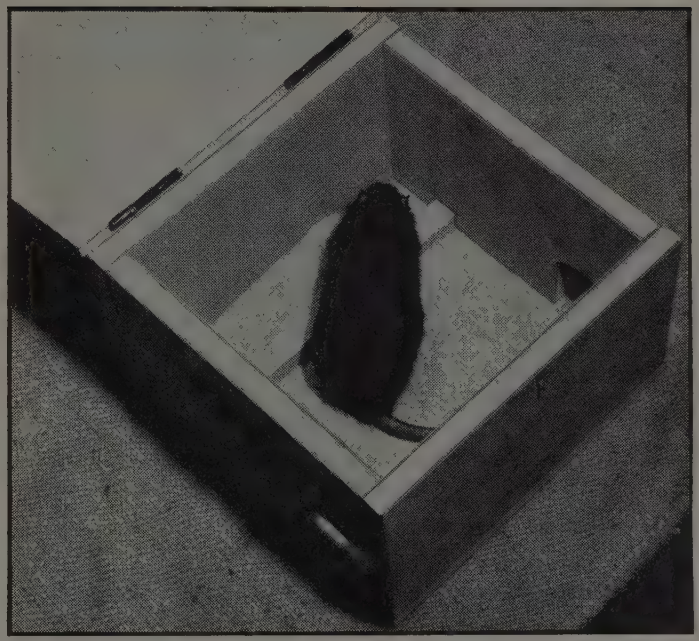
Whatever form of bait is used, it should be finely divided or minced. The advantage in this is that whereas lumps of meat and cheese can be carried away and stored, powders and sloppy mashes like bread soaked in water must necessarily be eaten on the spot. In a case of poisoning of fowls investigated at Wallaceville, the poultry farmer had laid numerous baits consisting of phosphorus paste spread on bread. The baits were laid in the poultry house under boxes so that fowls could not get at them, though they were accessible to rats. Instead of eating the baits the rats carried them out into the open and about a dozen fowls were poisoned. Such accidents cannot happen with powdered or minced baits.

In any poisoning campaign some time must be spent on finding what the rats will eat most readily and this is done by presenting a variety of baits of the type listed above and observing which are eaten. When this is done the selected bait should be fed liberally for three or four times either every night or on alternate nights. Where baits are completely cleaned up more should be fed on later baitings until enough is being fed to satisfy all comers. The placing of baits is of great importance and this will be governed by signs of rats such as droppings, oily or dirty marks from rat bodies on woodwork, on entry holes into buildings, and on beams where rats run along, holes leading to nests, rat burrows on the banks of ditches and streams, beaten tracks on earth, and signs in fowlhouses, stores, and other buildings.

Keeping Baits Safe from Children

All efforts must be taken to prevent other animals and children from getting at baits and numerous devices can be used. Boxes with holes large enough to admit rats can be used to cover baits, and wire netting of 2in. mesh can be shaped to give similar protection. A board leaning against a wall and nailed to it is an easy method where rats are obviously running along the foot of the wall. In burrows and holes the baits can be inserted with a spoon. Baits of all types must be protected from the weather. When rats are eating freely is the time to incorporate poison, but not before. All uneaten unpoisoned baits should be collected before poison baits are laid. The amount of poisoned bait laid is governed by the amount of prebait being eaten. There is little use in laying poison where prebaits are not being taken.

Everything that has so far been said about the necessity of prebaiting with the same type of food as that used for poisoning will make it quite clear why commercial rat poisons in which the poison is already incorporated into a foodstuff cannot be fully effective in destroying rats. It is much sounder practice to buy the pure poison and incorporate it into the chosen bait. A notable exception to this is warfarin (George C. Warner's compound 42) which is sold under a variety of trade names and which is already mixed with ground cereal. Usually 1 part of the compound as purchased is to be mixed with 19 parts of suitable bait material. The "suitable bait" material is best determined by trial.



A bait box 12in. x 12in. x 9in. high with hinged lid and rat entry holes 3in. x 3in. This is one of many types which allow baiting in places accessible to pigs, poultry, and household pets.

Warfarin has given exceptionally good results in New Zealand and elsewhere, and poisoning can be done successfully without prebaiting. This is probably due to the fact that warfarin takes an average of 6 days of continuous feeding before it exerts any effect and it does not cause any malaise in the early stages. A single large dose will not kill rats, and baits which are eaten must be replaced daily.

Other recommended poisons, but for which prebaiting is required, are:—

White arsenic (very fine powder): 1oz. of poison to 6oz. of dry bait mixture. In wet baits like bread soaked in water and minced raw meat or fish 1oz. of poison to 9oz. of bait material is used.

Zinc phosphide: ¼oz. to ½oz. of poison to 10oz. of wet or dry bait material.

Red squill powder: 1oz. of poison to 9oz. of wet or dry bait material.

Antu (alpha-naphthyl thiourea, compound 109): ¼oz. of antu to 10oz. of wet or dry bait material.

Barium carbonate: 1oz. of poison to 4oz. of bait material.

These poisons should be purchased from a registered pharmacist who will supply them properly labelled and with instructions about antidotal treatment if they are accidentally swallowed.

With the exception of red squill, which makes most animals vomit, all the above poisons are dangerous to man and animals when eaten. Warfarin in the concentration in which it is used in the final baits is not regarded as dangerous to humans. The poisoned meal is dangerous to pigs, and cats and dogs are poisoned by eating over several days the carcasses of rats poisoned by it. All poisoned baits should be laid where children, farm animals, and pets cannot gain access to them, and the concentrated poisons should be kept in bottles properly labelled and kept locked up. Carcasses of poisoned rats and mice should be buried as they are found. At the completion of a campaign all uneaten poisoned baits should be buried.

The usefulness and dangers of the various poisons are:—

Warfarin: Kills rats and mice; dangerous to pigs and pets; not regarded as dangerous to humans, but should be kept away from children; can be used continuously, but bait boxes must be kept replenished; no prebaiting required.

Zinc phosphide: Kills rats and mice, and is probably the best poison for the latter; poisonous to humans, farm animals, birds, and pets.

White arsenic: Kills rats and mice; poisonous to humans, animals, and birds.

Red squill: Kills rats, but is not useful against mice; baits are distasteful to poultry, but should not be made available to them; makes other animals vomit and hence is not very dangerous to them; one of the safest poisons for use by the general public, but not the most effective.

Antu: Most useful against the brown rat, but not so effective against the black rat or mice; virtually non-poisonous to poultry in small amounts; baits are poisonous to cats and dogs; sub-lethal doses set up a tolerance in the brown rat.

Barium carbonate: Kills rats and mice, but is poisonous to humans, animals, and birds.

With poisons other than warfarin there is little use in leaving poisoned baits out for more than 3 nights. Rats which have not received a lethal dose by then are not likely to eat further poisoned baits. It is better to start again after an interval using a different bait and poison. This interval can be determined only by experimenting with unpoisoned baits. Middleton stresses that the change of poison is important to avoid the effects of poison shyness, which may last for several months after an initial non-fatal dose.

For anyone who is diffident about handling poisons it can be stated that adequate protection is afforded by ordinary rubber gloves, which should be worn when handling white arsenic or zinc phosphide. When the latter is being mixed into baits the operation should be done out of doors or in a well-ventilated shed. Poisons should never be mixed in household utensils used for the preparation of food, and mixing vessels should be well rinsed after use.

Methods of Destruction other than Poisoning

Trapping. The rat has poor sight and likes to run along a wall, using his whiskers as feelers. This habit can be used to advantage by setting snap or break-back traps at right angles and with the trigger close to the wall or across obvious runways so that the trap may be sprung by the rat as it passes over it, even though the rat does not stop to feed. Traps are suitable for a casual infestation in dwellings or to deal with a minor infestation or a final clearance after a poisoning campaign. The aim should be to catch all rats on the first night if possible. If only one trap is used, rats may be warned by the first catch and become "trap shy".

A key point in trapping is to use sufficient traps to deal with the infestation in one stroke. For small infestations four or five traps are usually sufficient, but several dozen may be required in a large building where there are numerous rat runs. It is far better to use too many than too few. If traps are baited, they should be dummy set (baited but not set) for several nights until feeding has reached a peak and then set. To avoid accidents to children and pets and the trapping of birds traps can be protected by using them under a box with openings large enough for rats or under a board nailed to a wall.

The ordinary snap or break-back traps are best, but cage traps have their uses, as they are easy to set. Traps are often used by people who are prejudiced against poisoning because of the risk to pets and children and also because of the possibility of a poisoned rat dying in an inaccessible place and causing an objectionable smell. The belief that the handling of traps by man causes rats to become trap shy is unfounded, but it is good hygiene to scrub traps clean after use.

Fumigation. Fumigation with hydrogen cyanide is an effective method of rat destruction used on ships and in buildings which can be sealed. It is a highly dangerous procedure which can be carried out lawfully only by trained operators approved by the Department of Health.

There are, however, several slow-acting cyanide dusts marketed under various trade names. These dusts are decomposed by moisture in the air, giving off the poisonous hydrogen cyanide gas and leaving a residue of slaked lime containing very little poison.

These products are quite safe to use as long as care is taken and they are very useful in dealing with outdoor infestations. The method is commonly used on refuse tips, on river banks, or in places where a large colony of rats has burrowed and where poisonous baits have failed.

The method adopted is to block all rat holes as far as possible and on the following day those that have been reopened by the rats are treated by placing about an ounce of the dust inside each hole and then sealing it with rammed earth, care being taken not to cover the dust with earth. Provided there is sufficient moisture present in the burrow, a strong concentration of the poisonous gas is built up just inside the burrow and kills any rats trying to dig their way out.

A more satisfactory method of using the dust is with the type of dust gun used by rabbit boards in fumigating rabbit burrows. The end of a rubber hose is pushed about a foot into the burrow and packed with earth. The gun is worked and anywhere dust is seen emerging is blocked with earth. This method gives a lethal concentration of gas anywhere the dust has penetrated.

Both methods are not effective where the ground is very dry and porous and the gas can diffuse away readily.

When cyanide dusts are used in burrows leading under buildings housing animals or poultry the stock should be removed. Before dusts are used for burrows under human dwellings expert advice should be obtained.

Good results have been obtained by connecting a flexible hose to the exhaust pipe of a motor car and inserting and sealing the hose into burrows. The carbon monoxide produced will kill the rats inside.

Natural Enemies of Rats

Cats, dogs, and ferrets, being the natural enemies of rats, have a place in control measures and are useful in special circumstances. The effectiveness of cats and dogs can be assessed by the fact that in spite of the present numbers of these animals rats are flourishing. Domestic cats can sometimes deal with casual or minor infestations in dwellings and this gives rise to the widespread belief that keeping cats is a very effective method of keeping down rats. The value of cats as rat catchers is over-rated and when they are kept for that purpose in food premises there are many disadvantages. They pollute food, infest the place with fleas, and require regular feeding.

Cats are sometimes kept short of food by misguided individuals in the hope that hunger will prove an incentive to the hunter. Experience shows that this unnecessarily cruel procedure is not very effective. Experienced operators can quote numerous incidents to show that rats and cats can live and sleep in the same premises and even share food without being unduly concerned. When rat burrows are being dug out or when premises are being cleaned of refuse in cases of infestations, dogs or cats can be used to catch rats as they are disturbed. Professional rat catchers sometimes use dogs or ferrets for special jobs, but their effectiveness is limited.

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Trees on the Farm

THE cost of building and fencing timber and a better appreciation of the value of shelter have in recent years caused farmers to take a keener interest in tree planting. Unfortunately it is common for tree planting on farms to be neglected and much of the planting done has been haphazard. This article by W. H. Jolliffe, Officer in Charge, Extension Forestry, New Zealand Forest Service, is the first of a series which will deal with many aspects of growing trees on New Zealand farms.

TIMBER is constantly required on farms for new buildings and for repairs to old structures, for gates, posts, strainers, and battens, for props and rails, and for firewood. Wood in any form is bulky and hence costly to transport, especially where farms are far from distribution centres. The answer is surely to "grow your own". Trees are also required as shelter for stock and crops, as shelter and beautification for the homestead block, as a preventive or a cure for erosion, or as a crop on areas which are unsuitable for developing into grazing or cropping land.

There is, too, a national aspect to planting of trees on farms. In the supply of local demands for wood in all its forms it is more economic to have the raw material well distributed and so avoid costly transport, and farmers with their shelter belts and woodlots have played a big part and must continue to do so if a policy of wide distribution of timber lands is to be maintained. This is especially so in districts of predominantly high-class land, where the areas which it is economic to devote to tree growing are necessarily small. Success in using small areas lies in their being close to the headquarters of the planter and there being a constant local market for the many products of the woodlot; these conditions are fulfilled by the farm plantation.

TREES AS A CROP

It is surprising how many farmers cannot view trees as a crop. Most farmers consider that planting trees will benefit their children or grandchildren—a form of endowment—but more and more are now reaping a return from their own plantings.

In the usual close-spaced plantation thinnings should be made when the stand is between 10 and 15 years old. This first thinning will, according to the species, yield firewood, props, rails, and some posts. A second thinning some 10 years later will provide firewood, posts, some strainers and poles, and even a little saw timber. Later still all needs can be supplied. These thinnings can be organised so that after the tenth year work can be carried out annually in some part of the plantation to provide material necessary for the farm.

The following are examples of what can be done with trees as a crop:—

Case A, South Island: This plantation was established and run on orthodox forestry lines as a hobby by a professional man who lives 25 miles away. He is still in active control of operations in it.

HEADING PHOTOGRAPH: Good ridge shelter on a Wairarapa farm.

A partly swampy area of 55 acres of manuka, gorse, and blackberry was bought, surveyed, cleared, drained, and fenced, and planted in 1918 with radiata pines at spacings of 6ft. x 6ft. The early thinnings were wasted because there was no demand for firewood or small material. Later thinnings have yielded £13 5s. per acre for saw logs only.

The various costs (land and establishment and thinning and maintenance), when compounded at 4 per cent. interest give an expenditure of £51 per acre with trees at 35 years of age. When the returns from thinnings are compounded they become £18 per acre, leaving a debit at present of £33 per acre. The present value of the crop is £150 per acre (at a royalty of 6s. per 100 board feet for timber), which turns the £33 debit into a credit of £117 per acre. On a rotation of 35 years this means a profit of £3 6s. 10d. per acre per annum over and above the return of 4 per cent. on moneys expended, and takes into account all costs normal in commercial operation.

Case B, North Island: A farm property was dissected by several small deep gullies which did not lend themselves to ordinary farming, so the owner planted them with trees, mainly radiata pine. The area in trees was about 60 acres and the cost of establishment was £5 per acre. No pruning or thinning was done. Utilisation (clear felling) began when the trees were about 25 years old. When the trees were 30 years old the yield per acre was about 65,000 board feet of timber and 90 cords of firewood (branches, tops, and slabwood). These quantities at royalties of 6s. per 100 board feet for timber and 3s. per cord for firewood brought in £208 10s. per acre. The cost of the land and establishment, when compounded at 4 per cent., reduces the gross return to £180 per acre, which over a 30-year rotation represents a profit of £6 per acre per annum over and above the return of 4 per cent. on moneys expended.

The explanation for the better return in Case B is that the owner was living on the ground and it formed part of a well-kept farm where fire precautions were unnecessary and many of the costs incurred in Case A did not arise. Furthermore, the owner in Case B was able to sell the whole stand; in Case A only the saw logs could be sold. The owner in Case B has been constantly reaping a harvest for the last 10 years.

Crops Damaged by Opossums

THE damaged maize cobs shown in the accompanying illustration were taken from a 5-acre crop in the Horowhenua district that was so extensively attacked by opossums that its value as a greenfeed crop for cattle was seriously affected. Reports from Department of Agriculture instructors indicate that opossums appear to be spreading, but that they seem to damage principally gardens, orchards, and young trees planted for erosion control. Minor damage to maize crops is reported from Poverty Bay. Where small areas of crops are attacked by large numbers of opossums the pests can be quickly reduced by intensive trapping along fencelines surrounding the crop.

In districts with a dense opossum population the only worthwhile method of control is the organisation of a killer policy by gangs of experienced men. Rapid build-up of opossum populations by migration from other areas and natural increase necessitates repetition of an intensified killer policy every few years. Some 4 years ago such an intensive attack with poison baits in the Tolaga Bay district reduced a very heavy opossum population, but the pest has again increased to a stage where it is a menace to young tree plantations.

Trapping round the foot of trees and a jam and strychnine poison have been used in some districts to control the pest. Farmers in areas badly infested with large numbers of opossums have found that they are unable to control the pest by their own efforts, especially in sparsely settled districts.

Literature on methods of trapping and poisoning opossums and on the bounty scheme is available from the Wildlife Division of the Department of Internal Affairs, P.O. Box 8007, Government Buildings, Wellington, C1.

Sudden Death of Mr. J. H. Earl

MR. J. H. EARL, Assistant Director of the Dairy Division of the Department of Agriculture, died suddenly at Wellington on 13 February at the age of 64.

After coming to New Zealand from England as a young man Mr. Earl managed a number of dairy factories in the Waikato. He was manager of the Kakepuku Dairy Company, Pokuru, Te Awamutu, and in 1923 he was appointed to the Department of Agriculture as a temporary farm dairy instructor at Morrinsville.

In 1926, however, he resigned to become manager of the Waimana Dairy Company, Bay of Plenty, and in 1929 he rejoined the Department of Agriculture and was appointed Dairy Instructor and Grader at Auckland. He was sent to the Manawatu as Cheese Instructor in 1935 and in the following year was appointed Dairy Instructor and Grader at Hamilton in succession to Mr. H. A. Foy, the present Director of the Dairy Division, who had been transferred to London.

During the early part of the Second World War, when increased cheese production was required for Britain, Mr. Earl played a major part in organising the expansion of cheese production in the Waikato, which was a centre of the cheese production drive. He was also associated with the return to the emphasis on butter production, which came after 1942.

In 1945 Mr. Earl was appointed Dairy Produce Grader in Charge at New Plymouth, and the next year he was appointed Superintendent of Grading for New Zealand and was stationed in Wellington. He was appointed Assistant Director of the Dairy Division in 1951.

Lamb Growth on Pasture Topdressed with a Complex Trace Element Mixture

By I. J. CUNNINGHAM, Superintendent, Department of Agriculture Animal Research Station, Wallaceville

IN recent years many farmers have gained the impression that better growth of lambs can be achieved by topdressing pastures with one of the commercially available trace element mixtures; and this though there may be no evidence of trace element deficiency on the farms. In all cases known to the writer the farmer's opinion has been an impression only, for no farmers spoken to have reared and fattened lambs on such topdressed pastures and compared their weights at the works with those of similar lambs from untopdressed areas of the same farm. Many farmers indeed state that it is impracticable to make such a test; but despite absence of proof the impression is still fairly widely held that such topdressing is worth while, even at the high cost involved.

IT is not difficult to give an opinion of this practice. There are two possible effects from a trace mineral mixture used as a topdressing The first is direct improvement of animal health resulting from the supply of some missing trace element; the second is increased growth of pasture making more food available.

There are only three trace elements whose deficiency in New Zealand has a direct effect on stock health. These are copper, iodine, and cobalt. A marked deficiency of copper or of iodine will cause disease in lambs; copper deficiency causes enzootic ataxia and iodine deficiency goitre. A slight deficiency of copper or of iodine has no effect on growth-rate of lambs. Cobalt deficiency is in a different category, for both severe and mild deficiency will affect health or growth-rate of weaned lambs. Severe deficiency leads to death; a mild deficiency causes slower growth.

Thus in direct effect on animals cobalt is the only trace element which would improve the growth of lambs when used in circumstances where clearly defined disease conditions do not exist. These circumstances would occur only when cobalt was topdressed on land slightly deficient in cobalt.

Improved pasture production can result from the use of molybdenum or of copper. The areas that are molybdenum deficient are now reasonably well known and the responses that can be obtained from molybdate fertilisers are also well known. Copper is of more limited value and responses of smaller magnitude have occurred on some sandy soils and on some peat soils.

On the basis of this information an opinion of trace element mixtures for topdressing is that:—

No benefit is to be expected from complex mixtures as such.

Mixtures containing cobalt will produce better growth in weaned lambs if they are used on soils deficient in cobalt.

Mixtures containing molybdenum will produce more pastures if used on molybdenum deficient soils, and mixtures containing copper might produce more pasture on some sandy soils and some peats.

The remaining costly trace elements represent wasted money.

When such an opinion is expressed there are some who still remain unconvinced. They want the question tried out, because there might be some reaction as yet unforeseen resulting from the interaction of a complex mineral dressing. This is a reasonable enough attitude and the question has therefore been tried out in a small experiment at Wallaceville.

The experiment started on 13 July 1953, when two groups of 15 4-tooth Romney ewes were put on two appropriately topdressed areas; since that date the ewes have remained on their areas and reared lambs.

The first group is the control. It is kept on 2.5 acres subdivided into three paddocks. The second group is the trace element mixture group and it is kept on 2.7 acres subdivided into three paddocks and situated alongside the Group 1 area. The topdressing on these areas has been as follows:—

Group 1	Group 2
Before 1952	
Nothing	Nothing
March 1952	
2cwt. super./acre 1 ton lime/acre	2cwt. super./acre 1 ton lime/acre
September 1952	
3cwt. super./acre	3cwt. super./acre
8 July 1953	
3cwt. cobaltised super./acre	3cwt. cobaltised super./acre plus trace minerals (see table at top of next column)
22 March 1954	
3cwt. cobaltised super./acre	3cwt. cobaltised super./acre plus trace minerals
6 November 1954	
5oz. cobalt sulphate/acre as spray in water	5oz. cobalt sulphate/acre as spray in water

The trace element mixture used on 8 July 1953 and 22 March 1954 was:—

	lb. per acre
Boric acid	10
Zinc sulphate	10
Manganese sulphate	10
Copper sulphate	5
Potassium chromate	1
Nickel sulphate	5oz.
Ammonium vanadate	2oz.

The trace element mixture therefore supplied boron, zinc, manganese, copper, chromium, nickel, and vanadium, which are the elements usually claimed to be effective. The amounts employed are those found necessary in the different parts of the world where their deficiency exists. Where no such information was available the amounts were arrived at by analogy with similar elements; for example, the amount of ammonium vanadate is the same as is found successful for ammonium molybdate. Cobalt was supplied to both areas because a slight deficiency of this element is known to occur on the soil of the experimental area. The experiment therefore tested the effect of the trace elements in the list.

The lambs produced in 1953 were not regarded as significant to the experiment, because the ewes were on the pasture for only about 6 weeks before lambing. These lambs were disposed of in January 1954, when the average body-weight of Group 1 lambs was 7lb. heavier than that in Group 2.

It was felt that by 1954 any effect of the trace element mixture should be fully developed. Full data for lambs born in 1954 are therefore given in the next table. The lambs were weaned on 15 December 1954 and all were slaughtered on 26 January 1955.

LAMB WEIGHTS IN 1954-55

	Group 1 Super. + cobalt	Group 2 Super. + cobalt + trace element mixture
No. of ewes	15 (1 dry)	15 (none dry)
No. of lambs:		
Total born	18	17
Losses	1 broken leg	1 at birth 1 accidentally after birth
Net	17	15
Singles	11	11
Lambing dates	19/8/54 to 12/9/54	17/8/54 to 12/9/54
Average body-weight of lambs (lb.):		
At birth	8	8.5
7 Oct. 1954	29.7	33.4
11 Nov. 1954	41.4	45.6
2 Dec. 1954	57.2	60.3
20 Jan. 1955	71.7	71.1
Dressed weights of lambs (lb.):		
All lambs	31.6	30.0
Top 10	35.3	32.2
Top 6	37.0	34.5

It was necessary to kill all the lambs at once, which is of course not usual

practice. Average weights of the top 10 are shown in the table, as this would represent a good "pick" from Group 1. Average weights of the top 6 are also given, as 6 of the lambs in Group 2 killed out at over 30lb.

Whatever way the weights are considered there is no advantage from the use of the complex mineral mixture either in body-weight gains or in carcass weights. Thus on Wallaceville farm the use of a complex trace mineral fertiliser had no effect on carcass weight of lambs.

The opinion expressed earlier is therefore confirmed by this experiment and can be restated:—

There is no evidence that top-dressing with a complex mixture of trace minerals will improve lamb growth by providing for some unknown trace mineral requirement.

Book Review

"The Villiers Engine for Industrial, Agricultural and Horticultural Use": B. E. Browning

AS a large number of small engines are used as power units for the lighter agricultural implements such as lawnmowers, scythes, cultivators, small ploughs, and spraying machines, and also for other machinery such as concrete mixers, pumps, and elevators, any information which will enable these engines to be maintained in a high state of efficiency must be welcome.

The name Villiers is well known among the various small engines in use and the author of this book has recorded the experience gained over many years in close association with these engines.

The book gives full servicing and maintenance instructions for Villiers 2- and 4-stroke engines which will assist in obtaining maximum reliability and performance.

Two-stroke and 4-stroke engines are dealt with separately and the fault-finding charts given for both types should be of special value.

—H.W.T.E.

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Reinforcing of Concrete Posts

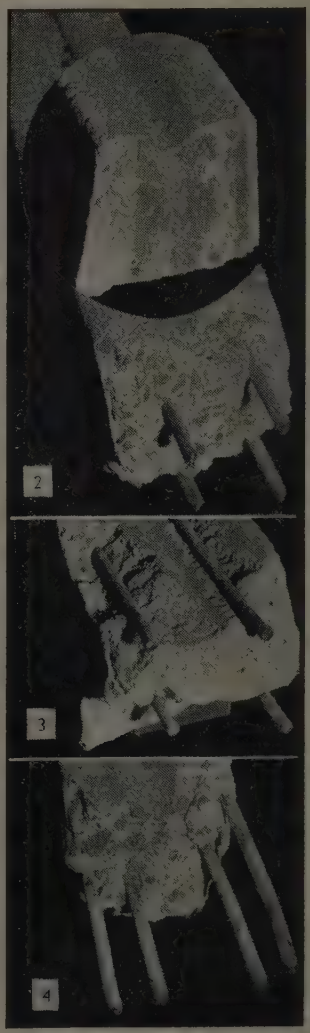
UNLESS reinforcing steel is correctly spaced in concrete posts, much time and material is wasted, as the posts will not stand up to the strains put on them.

STIRRUPS should be used to hold the reinforcing rods to the correct spacing for the type of post that is being made. Stirrups are a necessity if a vibrator is to be used during the manufacture of the posts, as the vibrating action tends to cause the reinforcing rods to move after placement in the moulds. If a vibrator is not used, the rods can be placed by hand as the moulds are filled, but care should be taken to see that they are not moved by subsequent tamping.

The simplest way to make stirrups is as follows:—

Four studs should be driven into a heavy board or bench at the same distance apart as the rods are to be spaced. Some No. 10 or No. 12 gauge wire should be looped round these studs with four holes through which the rods can be passed (Fig. 1A). Fig. 1B shows how the stirrups and rods should be made up for proper placement of the reinforcing in the post mould. The ends of the wire used in making the stirrup can be left as shown in Fig. 1 to help locate the rods in the mould. By alternating the position of the wire ends on different stirrups a fairly accurate placement of reinforcing rods can be got. Fig. 3 and Fig. 4 show the effects of the reinforcing rods moving after they have been placed in the moulds. In Fig. 3 one reinforcing rod is on the surface of the mould groove and in Fig. 4 the rods are almost in line. Neither post would give the service that could be expected of a concrete fence post. Fig. 2 shows two examples of correctly placed reinforcing. In the inset sample markers have been placed on the cut portion of the post to indicate the positions of the rods.

—C. M. B. OLIVECRONA,
Machinery Instructor,
Department of Agriculture,
Wellington



Sections of concrete posts. Fig. 2 (and inset)—Correctly placed reinforcing rods. Figs. 3 and 4—Poorly placed reinforcing rods.

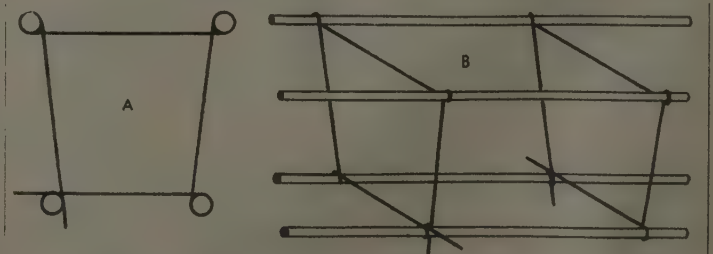
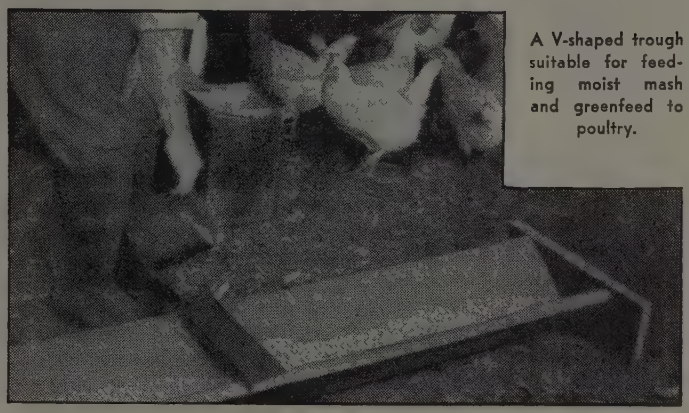


Fig. 1—Stirrup (A) and stirrups and reinforcing steel (B) made up ready for use.

The Feeding of Household Laying Birds

TO obtain a continuous supply of eggs from laying birds it is important that the birds be fed a balanced diet of good-quality food. A question commonly raised by the household poultry keeper is what type of food is required for the birds to give the best results. Many poultry keepers of course wish to incorporate house scraps such as meat, bread, and potatoes, while those on farms may desire to utilise milk or curds in the birds' rations. Here H. H. Watson, Poultry Instructor, Department of Agriculture, Wellington, describes various methods by which the household poultry flock can be fed with success.



A V-shaped trough suitable for feeding moist mash and greenfeed to poultry.

THERE are several recognised systems of feeding laying birds, all of which will give satisfactory results if carried out correctly. Each has its advantages and disadvantages, and the householder must decide which one is convenient for his requirements.

The feeding of mash either dry or moistened with grain has proved to be extremely popular with many poultry keepers in New Zealand. Since the last war these poultry keepers have had to buy ready-mixed mashes, No. 1 or No. 2 standard laying mashes.

It is important to know that these mashes differ vitally in one respect: No. 1 laying mash contains 10 per cent. of meat meal (animal protein supplement) whereas the No. 2 mash contains no meat meal.

These ready-mixed mashes are available from merchants and storekeepers and sold in bag lots to suit the householder.

Feeding Systems

The feeding of a moistened mash early in the morning has its advantages, as household scraps from the previous day can be added to the ration. The mash can be moistened and mixed to a crumbly state with either water or skimmed milk. As much mash as can be consumed in 20 minutes to ½ hour should be fed to the birds in a V-shaped trough (as illustrated). At noon the birds can be given a supply of greenfeed and for the evening meal mixed grains. The grain should be consumed in approximately 20 minutes from the time it is fed to the birds. It is advisable to ensure that the birds are not receiving too much grain, and to do this it is necessary to turn the litter over with a fork before the birds go to roost. Surplus grain in the litter encourages vermin such as rats and mice. To maintain satisfactory egg production, particularly during autumn and winter, additional meat meal to that contained in a No. 1 laying mash may be necessary. This food could be fed ad lib. in a small hopper or container which should be closed at night to discourage vermin and opened again when the birds receive the morning mash.

The feeding of dry mash in hoppers saves time and labour, but with this system more mash is consumed over a year than in moist mash feeding. The birds have free access to the mash during the day and care should be taken that they cannot spill it out of the hoppers, as this is wasteful and adds to the expenditure of feeding. Again meat meal should be fed ad lib. with greens during the day and a grain ration late in the afternoon.

The dry mash and grain feeding system is gaining popularity with households whose members are away from home during the day or even overnight. Where the householder and his family are late in returning home the birds should be fed with a grain ration earlier in the day. With the mash and meat meal in hoppers the birds have access to sufficient food. Of utmost importance is the provision of an adequate supply of drinking water.

At present poultry mash can be bought compressed into pellets which are fed in a similar way to dry mash. Owing to the pellets being compressed feeding of them can cause greater consumption of food in winter than with dry mash feeding.

[*Niederer*

This hopper built into the partition of the fowlhouse is suited to the feeding of either dry mash or pellets. The hinged lid can be closed at dusk to prevent vermin from eating the food. The section at the right end is suitable for holding meat meal.

Grain Mixtures

Many poultry keepers believe that birds will consume only wheat, but tests have proved that birds lay as well when fed with a ration of mixed grains. During autumn and winter a grain ration comprising wheat, maize, and barley is suitable, and during spring and summer good, plump oats may replace either the barley or

maize. The choice of grains fed to laying birds depends on the availability and cost of the various ingredients. Care should be exercised when poultry rations are being changed, and all changes should be introduced gradually. For example, a sudden change from old season's wheat to new season's wheat or to another variety of grain can be sufficient to upset the birds and bring about a neck moult or even a full moult, particularly if the sudden food changes are made during autumn or winter.

Poor-quality and musty grain should not be fed to poultry, as this type of food can also upset the digestive system and cause a loss in production from laying birds.

Greenfeed

Under average conditions a householder has lawn clippings and vegetables from the garden to provide greens for the birds for several months of the year. During summer and following months the supply of succulent greenfeed may be limited and the feed may deteriorate owing to dry weather. At this stage it is advisable to augment the diet with a good-quality fish oil, which is rich in vitamin A. The oil can be mixed into either the mash or the grain at the rate of 2 tablespoons to every 5lb. of total food given to the birds. The oil should be mixed into the ration daily, as it loses its vitamin value when left exposed to the air for any length of time. The container in which the oil is stored should be kept airtight in a cool place when the oil is not being used.

Curd Feeding

Where householders have a cow and where surplus skimmed milk is available it is possible to utilise this valuable by-product. The skimmed milk can be placed in a wooden drum and allowed to curdle. It is essential that the whey be drained off and the curds left to dry. Unless curd is well drained and dried, it may cause the birds to scour, as the whey produced during curdling is very acid. The curd or solid can be mixed with a little mash to dry it further and then fed in troughs to the laying birds. This type of feeding can take the place of moist mash feeding. Meat meal can be fed ad lib., with greens provided during the day and grain in the evening.

Grit

All birds require an unlimited supply of calcium grit such as oyster or pipi shell to supply lime in addition to that in the mash. This ensures an adequate amount for forming the shells of the eggs. A supply of hard metal grit such as ¼in. screenings is also beneficial to the birds, as this grit lodges in their gizzards and assists in grinding the food. Both types of grit should be placed in hoppers and kept in front of the birds at all times.

Advantages of Mob Stocking on Hill Country

By C. J. HAMBLYN, Fields Superintendent, Department of Agriculture, Palmerston North

MOB stocking with sheep, that is, shifting the sheep in as large mobs as possible round paddocks in turn, is having a remarkable effect on hill country pastures. Mob stocking with the ewes from weaning time in January to lambing in August is being adopted by an ever-increasing number of hill country farmers who are more than pleased with the results in both improved pastures and increased winter carrying capacity, particularly where the practice is combined with topdressing and oversowing with clovers.

ONE of the outstanding effects of autumn and winter mob stocking with sheep is the increase in the useful grazing area which results when very big mobs of sheep are used in relation to the size of paddocks. A thousand sheep in a 50-acre paddock or 2000 in 100 acres soon clean up the whole area, shady faces, steep sidelings, dry knobs, and all. When oversowing is done this allows the clovers, especially white and subterranean, to get established everywhere. The spells allow fresh growth to come away and young clovers to get established.

Even Spread of Dung and Urine

With mob stocking the dung and urine are evenly spread over the whole paddock and the pasture soon shows the benefit of this treatment. The usual camping grounds and favourite feeding places, a regular feature of paddocks which are set stocked, soon disappear and the whole area is brought into production. Mob stocking with ewes and lambs, when they are old enough to be easily shifted in spring, has an even more remarkable effect in this way than autumn mob stocking.

Control of Condition of Ewes

In autumn the condition of the ewes can be more easily controlled with mob stocking. They can be kept fit and in good working condition in late summer and feed suitable for flushing can be grown ahead of them for use before tupping. By a speeding up of the rotation during late autumn, feed can be left in each paddock in turn, the grass and clovers having sufficient leaf to grow on into winter. With set stocking, on the other hand, as soon as the pasturer are eaten bare in early winter growth comes to a standstill. By use of mob stocking grass can thus be saved in the paddocks for bringing the ewes up in condition before lambing.

HEADING PHOTOGRAPH: Mob stocking on a Manawatu hill country farm.

Spring and Summer Mob Stocking

As yet only a few hill country farmers have developed the practice of mob stocking in spring and summer, the time of the year when most good to the pastures results from mob stocking. The spelling and quick grazing off of the flush of growth are far more effective in October and November in improving the pastures, as the better species are thus given a chance to compete with the poorer grasses and weeds. Mob stocking at this time of the year will enable the ewes and lambs to be confined to a portion of the farm, say, two-thirds. With the help of the cattle they can keep this portion of the farm in good grazing order. The other third is closed for a few weeks and will provide excellent feed for the breeding cows in December and January while they are run with the bull.

After being cleaned up by the cattle these paddocks are ideal for weaning the lambs on to. As long as the main flush of feed in October and November is controlled by concentration of ewes and lambs with cattle on portion of the farm during the main flush of growth the sheep can be relied on to keep this grass controlled in December and January while the cattle are cleaning up the spelled areas. This control of the growth on as much of the farm as possible promotes grass growth into summer and helps the good grasses and clovers to hold their own against weeds and inferior grasses. The whole of the grass produced is passed through the animals back on to the land as dung and urine many times to the benefit of the pastures and eventually of the stock, whose numbers can also be increased.

The Home Garden in April

EVEN where conditions are favourable prospects in April are generally better for planting than for sowing in the home garden, because though growing conditions in certain localities may be very good in April, the progressive shortening of the hours of daylight and the relative coolness of the nights are a forewarning of the approach of winter. For the keen home gardener, however, an "Indian summer" or mild, sunny prolongation of late summer weather during April is specially appreciated, as good use can be made of favourable weather to complete the many routine garden tasks or to improve garden facilities or layout. In this article A. G. Kennelly, Horticultural Instructor, Department of Agriculture, Dunedin, discusses work in the vegetable garden during April.

FROST can be expected in most districts in April, and the harvesting and storing of crops such as onions, kumaras, pumpkin, marrow, and squash should be completed before low temperature or frost damage occurs. Low temperatures should be avoided for kumaras, particularly if they are to be stored, and frost is liable to damage subjects such as pumpkin, marrow, squash, and onions. Though the damage may not be apparent immediately, keeping quality is likely to be affected.

The pods of dwarf and runner beans should be picked regularly before they are much more than half-grown to encourage plants to remain in bearing. If more beans are available than are needed immediately, they can be preserved by salting. Good recipes are available in most cookery books, and if preserving has been done correctly, the home gardener will have available for many months a supply of beans that are not inferior in flavour to freshly picked ones.

Leeks should be earthed up as they develop if long, blanched stems are wanted. Celery too should be blanched by being earthed up or by the use of suitable reinforced paper or boards along the sides of the beds as described in last month's home garden notes. Ground should be cleared and dug over as each crop is finished and refuse put on the compost heap or dug in, and if the land is not wanted for several months, a green crop should be sown. Seed of crops such as lupins or mustard can be sown where temperatures are not too low. Elsewhere oats or barley can be sown.

Though generally the season of growth for tender and half-hardy crops such as marrow, pumpkin, cucumber, and tomato is finished, steady growth can be expected from hardy plants such as those of the cabbage family, leeks, silver beet, and spinach. Few kinds of vegetables should be sown in the open at this time even in favourable districts, though hardy quick-maturing vegetables such as spinach and radish can be sown in most well-drained soils that are not too cold. Vegetables such as cabbage, cauliflower, silver beet, and lettuce should be set out in most districts, but seed should be sown only if the soil is well drained and fertile and the aspect and situation are favourable.

In some districts a sowing of peas can be made toward the end of the month and in most districts broad beans can be sown.

Asparagus

It is not advisable to cut the top growth of asparagus until the foliage begins to turn yellow through the onset of cold autumn weather. While the tops are green the plants are manufacturing plant food and building up crowns from which strong spear growth can be cut next spring. If, however, cutting is deferred too long, the seed ripens and falls and the young plants which come up the following season are often unnoticed and become established to the detriment of the bed. Fern growth can be cut with

Heading photograph by Green and Hahn.

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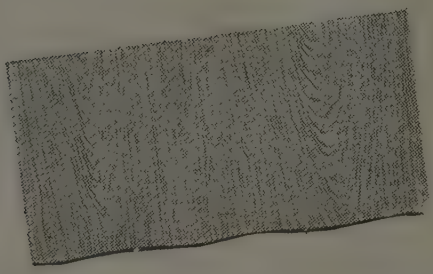

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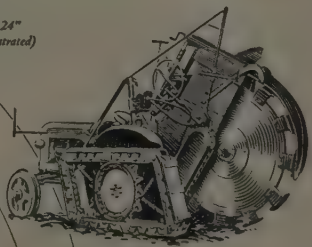

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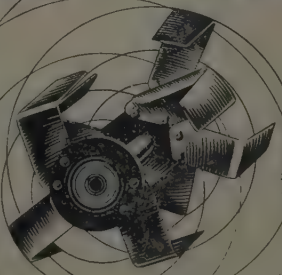

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hedge shears which have notched blades or with a sharp knife and the bed should be weeded afterward if necessary. The top growth is sometimes left to dry and then burnt on the bed, but it is preferable to put it on the compost heap.

Celery

In most districts celery will have reached its maximum development by now, and if it has not yet been blanched, that work should be done as advised in last month's home garden notes. In districts where a favourable growth period can still be expected self-blanching celery can usually be improved after the blanching material has been put in position by being watered with sulphate of ammonia or nitrate of soda at about 1oz. to 2 gallons of water. This usually stimulates growth, causing elongation of the heart and leaf stems and improved texture.

Regular spraying with Bordeaux mixture (4oz. of bluestone and 5oz. of hydrated lime in 4 gallons of water) or suitable Government Certified copper fungicide should not be neglected, as the celery leaf spot disease spreads rapidly in the moist conditions which usually prevail in late autumn.

Carrots

Autumn sowing of carrots is not advisable where winter conditions are cold enough to check growth severely, but on light, well-drained soils in favourable situations a small sowing of short or half-long carrots can be made in many districts in April as advised in last month's home garden notes.

Sowing on ridges or in a raised bed is usually an advantage. The rows on a raised bed need not be more than about 6in. to 9in. apart and for convenience of harvesting the bed should not be wider than 3ft. to 4ft. It is usual to harvest the roots before they are fully mature, and thinning should therefore be unnecessary, though weed control should be rigorous.

Onions

Harvesting and curing of onions for long keeping should be completed as soon as possible as advised in last month's notes. As the weather after April becomes progressively less favourable for drying the bulbs, only sound well-formed bulbs which have been properly cured should go into long storage; others should be put aside for immediate use. Small quantities can be strung or stored in open-mesh bags in a cool, ventilated shed or cellar, but because of the injury which often results when there is a heavy weight of onions in a bag it is advisable when storing considerable quantities of onions to use specially made slatted storage crates or to store them on slatted shelves. Onions should not be exposed to direct sunlight during storage, as it may promote early growth. If it is necessary to store them outside, a dry, sunless position where there is good air draught is desirable. The onions should be covered against rain and preferably placed on a structure far enough above ground to enable air to circulate under them.

[*Green and Hahn*

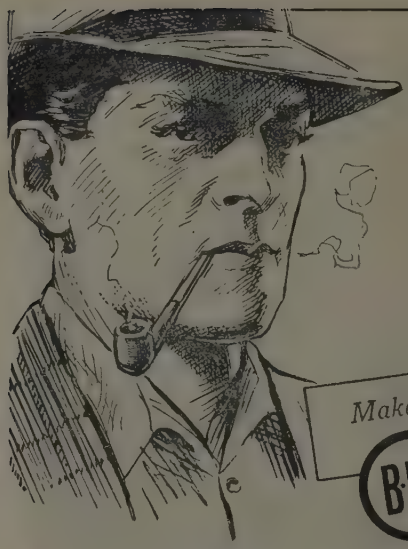
Asparagus tops should be cut before the seed ripens; otherwise the seed may fall and germinate and the young plants will establish to the detriment of the plants in the bed.

Though autumn sowing of main crop onions is a fairly general practice in the North Island, it is rarely done in southern districts. In most districts late March or early April is considered the best time for autumn sowing. In southern districts the onions are not usually thinned, but are kept cultivated and grown on until about November or December, when they are used as "thick necks" without being encouraged to form large bulbs. In most northern districts, however, the plants are lifted in early spring and set out in rows 12in. to 15in. apart with the plants 4in. to 6in. apart in the rows.

Autumn sowing in some districts is rather risky, and where winters are severe success depends to some extent on the season. Early frost will sometimes "lift" and damage late-sown crops, whereas if the seed is sown too early or if a long period of mild weather precedes a very severe cold period, the plants sometimes run to seed before they have developed adequately.

Though this is true of autumn sowing in general, in the north, where winters are less severe and mildew is more troublesome on the later crops, the risks are much less and autumn sowing and transplanting of the main crop are quite common. For autumn sowing the ground should be deeply cultivated and broken down to a fine tilth. It should be gently firmed, but care should be taken where the soil is heavy to avoid firming it too much, as the heavier soils tend to consolidate excessively where they are subjected to frequent winter rains.

If well-rotted stable or farmyard manure is available, it should be incorporated some time before the final preparation of the soil is begun. Best use can be made of such manure by adding to it about a thirtieth of its weight of superphosphate and applying it to land on which the crop is to mature. If keeping-quality onions are required, it is not advisable to apply excessive quantities of organic manure in spring, as the bulbs may be stimulated into excessive leaf growth and weed growth is liable to be more troublesome.



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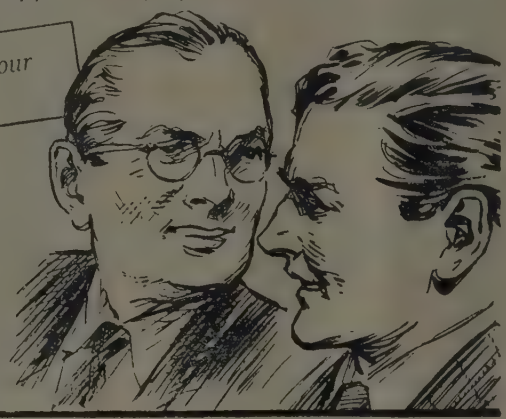

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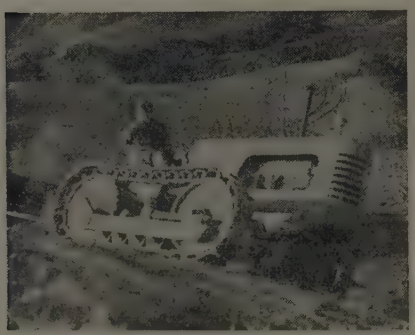

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Potatoes for long storage should not be dug until they are mature. [*Sparrow*

Few home gardeners are likely to have much farmyard manure, and available organic matter such as compost plus a complete fertiliser applied at the rate of about 3oz. to 6oz. per square yard should be used. Because of the great variation in soils and their condition throughout New Zealand only local experience and knowledge can indicate fertiliser requirements, but if soil conditions and fertiliser placement are correct, it seems difficult, judging by experiments that have been carried out, to over-fertilise onions. In general a fertiliser high in phosphoric acid but containing a liberal amount of potash and a smaller amount of slowly available nitrogen will give excellent results. The phosphoric acid and most of the nitrogen for early planted crops can be supplied conveniently by finely ground bone meal and the potash can be supplied by muriate or sulphate of potash.

The practice of growing onions on the same land for several years in succession has not much to commend it. It probably arose from a recognition of the high fertiliser needs of the onion and consequently the desirability of maintaining an area of the garden in very high fertility and regarding it as the onion bed. However, rotation is just as important in growing onions as in growing other crops, as diseases to which the crop is specially subject tend to build up in soil unless crops are rotated. In addition, most other vegetables grow well without further fertiliser on land that has received the heavy fertiliser applications usually given to onions.

Onion seed should be sown ½in. deep at the rate of 10 to 20 seed per running foot in rows 12in. apart in finely cultivated soil.

The growth of onions, unlike that of most other crops, is not usually seriously affected by moderate crowding in the rows, and provided the seed is not sown too thickly thinning should not be necessary on most soils. Good varieties of onions are Ailsa Craig, Straw Spanish (early), and Pukekohe Long Keeper (main crop).

Potatoes

Potato tubers increase in size until the haulms die, and for maximum yield they should not be dug until then. Most potato crops should be mature or nearly mature by the end of April, and though it is not advisable to dig potatoes for long keeping until they are mature, digging should not be deferred if they have reached maturity. Where this is in doubt potatoes can be tested for maturity by digging one or two plants. The skins of mature tubers should be so well ripened that they do not rub off easily and are not readily scarred or bruised in handling. Potatoes dug a considerable time before full maturity are tender with easily broken skins that fluff and curl in fragments

A number of diseases may cause potato leaves to appear scorched or to die prematurely. The common potato blight (late blight or Irish blight) causes dark brown to black irregular spots, usually fast growing, on the leaves and stems. The decaying tissue usually has a noticeable odour and white mildewy growth is often present on the undersides of the affected leaves and stems. Common potato blight can be controlled by spraying with Bordeaux mixture or copper oxychloride sprays but the spray must be applied early and regularly as its function is chiefly protective. Most other diseases which cause potato leaves to become scorched or to die back are due to diseases affecting the tubers or young shoots. They are numerous and some knowledge of the diseases affecting potatoes is needed to distinguish one from another, but control usually consists of good husbandry and growing clean preferably Government Certified seed in soil that is not infected with disease likely to affect potatoes.

Premature drying and browning or leaf scorch of potato foliage due to deficiency of potash or more commonly an unbalance of fertilisers causing such a deficiency is common, more particularly on dry or sandy soils than on good soils that contain plenty of organic matter to retain moisture, as the condition tends to be more severe under semi-drought conditions

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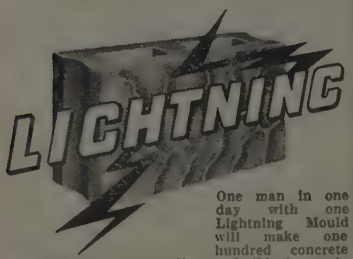

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than when there is plenty of rain, though it is common in wet seasons. The leaflets are at first hard and bluish green and then turn yellow at the tips. They are marked on both the yellow and the green by brown spots in patches between the veins, and the leaf edges appear scorched. As the trouble progresses whole leaves dry up, leaf stalks double over, and finally the main stem collapses.

This type of leaf scorch is often severe on alkaline soils high in lime, especially when phosphates are also high, though it often also occurs on soils of average lime and alkalinity when phosphates are high and potash is average. The trouble tends to be most severe on soils of average to fairly good growth where the plants have enough of other nutrients to exhaust the potash and then suffer from the lack of it. The trouble is less likely to occur on poorly grown crops, because they are rarely highly fertilised with nitrogen and phosphorus.

This type of premature drying, browning, and scorching of foliage occurs only toward the end of the growing period, and if the leaf markings are superimposed on the normal autumnal yellowing of the leaves, the crop will be little affected. However, where it develops as it commonly does about a fortnight after flowering or when the plants are making their maximum growth of haulm the reduction in yield may be considerable.

Control consists of the maintenance of adequate organic matter in the soil and balanced manuring. Soils where the trouble occurs usually are not so much low in potash as low in potash in relation to phosphorus or more rarely low in potash in relation to nitrogen.

Satisfactory growth of potato crops can be obtained on a great many New Zealand soils by the application of adequate nitrogen and phosphorus, usually in the form of blood and bone or sulphate of ammonia and superphosphate, but where deficiencies of the type described above occur the rates of application of the commonly used fertiliser dressings which supply nitrogen and phosphate should be reduced where growth is usually good or preferably a complete, balanced fertiliser containing nitrogen, phosphorus, and potash should be given.

Spring Cabbage

If early spring cabbage is desired, sturdy, well-grown plants with good root systems should now be set out. The soil should be rich in organic manure, and in most home gardens heavy dressings of organic manure such as farmyard manure, stable manure, or compost or a moderate dressing of fowl manure are advisable. If the soil has not been limed recently and there is a risk of its being acid, a dressing of 3oz. to 4oz. of lime per square yard is advisable. Heavier dressings may be necessary on some soils in high-rainfall districts, but as the effectiveness of lime is in direct relation to the closeness of its contact with the soil particles, it should preferably be applied some time before planting. Distribution should be as even as possible and incorporation should be assisted by at least one forking over. Thoroughness of distribution is important, because there is little or no sideways spread of lime in the soil after it is applied, though

[*Sparrow*

Pumpkins, marrows, and squashes are readily damaged by frost and should be covered or gathered and stored before the first damaging frost.

[*Sparrow*

If bean pods are picked regularly, plants are likely to bear longer. Pods in excess of immediate requirements can be preserved by salting.

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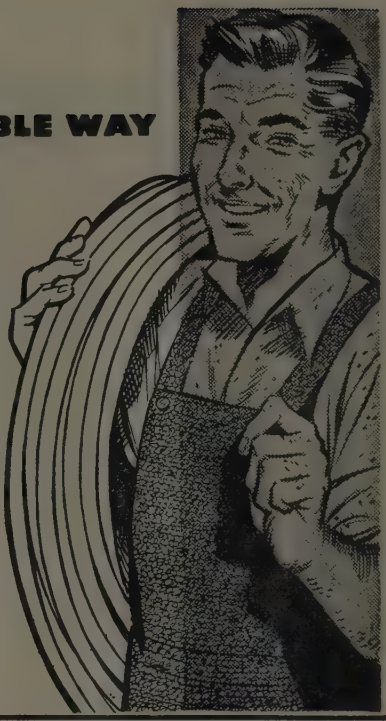

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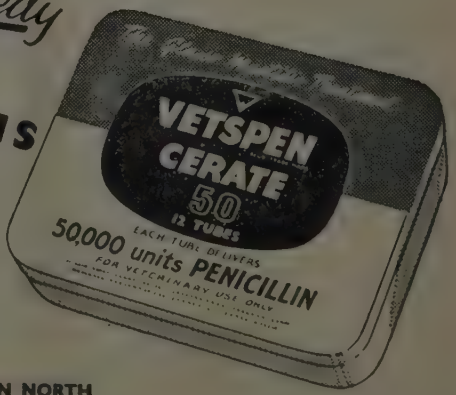


GLAXO LABORATORIES (N.Z.) LTD., PALMERSTON NORTH

[*Green and Hahn*

Leeks are one of the most useful vegetables. The blanched area of stems can be lengthened by earthing up as shown.

its downward spread is assured by the leaching action of rain-water.

Though the manurial requirements of cabbages are heavy, care should be taken to distribute fertilisers or manures evenly, as young plants are liable to be checked if the roots come in contact with too heavy concentrations of manure. Where organic manures such as farmyard, poultry, or stable manure, old stack bottom, or compost are not available a green crop should be dug in, and, except where the soil is very rich, the organic manure or green crop should be supplemented by a complete fertiliser, containing nitrogen, phosphoric acid, and potash, at the rate of about 2oz. to 5oz. per square yard.

Additional side dressings of nitrogenous manures such as nitrate of soda or sulphate of ammonia are often advisable, particularly where the organic matter applied to the soil is of a strawy nature rather than sappy and well rotted and when quick, forced growth is required, as in early spring. Flower of spring and Enfield Market are popular spring cabbage varieties in most districts, though in the north Jersey Wakefield is prominent among the somewhat limited spring cabbages grown.

Spring Cauliflower

The requirements of cauliflowers are similar to those of cabbage except that cauliflowers are more sensitive to adverse conditions such as extremes of heat and cold, wetness and dryness, or cold winds, and if checked, they are likely to "button", that is, form only useless miniature heads. Frosts, too, will damage the curds, and the injury so caused is likely to permit the entry of soft-rotting organisms. Cauliflowers should therefore be planted out only in districts where winter conditions are not too severe. In unfavourable situations planting is best deferred until late July, August, or even September. Good hardy varieties of cauliflower suitable for planting now are Walcheren, All Seasons (All Year Round), and Early London. Cauliflower plants are obtainable from most seedsmen.

Sweet Potatoes

Home gardeners who grow sweet potatoes usually leave the main crop to develop as long as possible, as sweet potatoes gain rapidly in total yield and the table quality of mature tubers is better than that of immature ones, but where tubers are to be stored, digging should be completed before there is risk of low temperature injury. Even if it is not intended to store tubers and an unusually early frost kills the tops, it is advisable to remove them promptly, as rots develop in the foliage and sometimes penetrate to the tubers. When sweet potatoes are mature enough for storage the skins should be reasonably firm. They can be tested by cutting, as when they are cut mature tubers dry rapidly and cleanly on exposure to the air.

Most varieties of sweet potatoes are likely to be injured when the temperature falls to 40 degrees F. (8 degrees above freezing point) and the keeping quality is so seriously affected that long storage is usually impossible. For best results the tubers should not be subjected to temperatures below 50 degrees F. If they are carefully harvested and properly cured and stored, it should be possible to keep them until next season's crop is ready, but if digging is delayed until after frosts and tubers are left for several days in wet, cold soil, loss during storage may ultimately be very high. Even a few days at 40 degrees F. may cause discoloration, and if the tubers are set to grow shoots for cuttings, poor sprouting is likely to result.

To ensure that their quality remains at its best from one harvest to another tubers should be handled with care. Badly damaged ones should be rejected and the remainder subjected to a period of fairly high temperature and humidity to cure them and enable wounds to heal. They should then be stored in conditions of scrupulous hygiene at a temperature of not less than 50 degrees F.

Where small quantities are being stored a reasonably warm shed or cellar is usually suitable if the tubers are placed in dry sawdust or dry sand. Deep placement in dry sand will pre-

vent rats from getting to them. Where large quantities are stored a pit or bank similar to that used for potatoes is occasionally used, though it is not generally recommended. However, a pit may be satisfactory if it is well made and insulated against cold and wet and there is room for a person to move about in it. It should be clean and vermin-proof, as rats and mice not only eat the tubers but spread diseases that cause rotting. Lined storage places, bins, and containers that are used year after year should be sprayed with a suitable fungicide before being used. Copper sulphate (¼lb. to about 12 gallons of water) makes a suitable spray.

Proper curing is as necessary as care in lifting and handling. In New Zealand curing of a kind is usually done by gathering the tubers into heaps and leaving them for about a week, keeping them covered during rain or at night with their vines or old sacks. Where temperatures are sufficiently high quite fair results are usually obtained from this method. By the time the tubers are ready for storage damaged ones which may have been overlooked have begun to decay and can be rejected. If tubers are to be properly cured in the field, they should be subjected to temperatures of not less than 70 degrees F. and fairly high relative humidity day and night for as long as 3 to 4 weeks or more. Such long curing is not usually a practical proposition in New Zealand, however, because of the need to grow the plants for as long as possible. Curing for too long may also result in excessive sprouting.

It is rarely possible for the home gardener to cure his sweet potatoes under ideal conditions. It is difficult even for the commercial grower unless large quantities are grown and stored, as a strict routine must be followed.

Tomatoes

Most districts experience frost in April, and where more than a few degrees of frost are likely it is advisable to gather all tomatoes that are reasonably mature. Well-coloured fruit can be put aside for immediate use or for preserving; the remainder should be stored in conditions that enable ripening without collapse or softening.

Home gardeners often put fruit on a sunny windowsill or expose it under glass to the sun to colour and ripen it, but such treatment is usually advisable only with fruit that is nearly ripe; otherwise the fruit will be soft and rubbery before it ripens. Sound green fruit that is dry and reasonably mature though not coloured can be packed in boxes and the boxes stacked one on top of another in a shed, or the fruit can be wrapped individually in paper or stacked in a box with material such as clean straw or a double layer of scrim between each layer. A temperature of about 50 to 60 degrees F. is satisfactory. Mature fruit will ripen fairly well if the tomato plant bearing it is pulled up by the roots and hung up in a shed. Light is not necessary for ripening. Temperature, humidity, and control of atmospheric gases—carbon dioxide is the retarding factor—are all important.

Under ideal conditions higher temperatures than 55 to 60 degrees F. are desirable, though humidity must be closely correlated to it. Higher temperatures without humidity will cause fruit to soften or become rubbery. In humid conditions fruit must be picked over regularly, as rots develop very quickly.

Where a relatively large number of plants are grown and there are more tomatoes than can be consumed immediately the excess should be preserved. Tomatoes are particularly good as a source of vitamin A, which promotes growth and protects the eyes, and vitamin C, which is essential for healthy tissues and teeth. They also have a smaller amount of vitamin B, which aids growth and digestion and is said to be particularly good for the nerves. Correctly preserved tomatoes retain much of their vitamin content and are therefore most valuable for use during winter.

Meteorological Records for January

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	67.6	+ 2.7	84.6	46.7	0.91	7	— 3.59	0.35	10	250.1
Auckland	160	67.9	+ 1.5	81.9	54.2	0.59	9	— 2.59	0.11	10, 21	222.2
Tauranga	10	66.7	+ 2.1	81.1	46.0	2.28	9	— 1.66	1.11	25	260.7
Ruakura	131	64.2	+ 1.1	81.7	39.9	0.68	9	— 2.80	0.45	21	212.9
Rotorua	975	64.6	+ 1.8	81.0	40.0	0.89	11	— 3.47	0.36	21	221.6
Gisborne	12	65.1	+ 0.3	87.4	42.3	1.65	5	— 0.89	0.76	17	252.9
New Plymouth ..	160	63.0	+ 0.8	74.0	46.0	0.98	7	— 3.49	0.27	21	243.3
Kariol	2125	59.0	+ 2.0	79.2	32.0	1.32	8	— 2.36	0.61	21	
Napier	5	66.0	+ 0.5	87.5	46.8	0.77	6	— 1.84	0.44	21	263.1
Wanganui	72	65.0	+ 1.5	82.8	44.7	0.69	5	— 2.09	0.35	22	263.9
Palmerston North ..	110	64.0	+ 1.6	82.5	40.0	0.99	10	— 2.21	0.32	2	221.6
Waingawa	348	63.3	+ 0.9	87.0	40.0	0.92	4	— 1.48	0.26	27	260.1
Wellington	415	61.6	+ 0.6	76.8	46.2	0.39	3	— 2.69	0.18	21	228.9
Nelson airfield ..	5	62.2	+ 0.6	79.0	47.1	0.49	6	— 2.35	0.22	10	269.4
Blenheim	12	63.7	+ 1.1	86.0	41.1	0.15	3	— 1.84	0.10	17	251.0
Hokitika	15	57.8	+ 0.3	69.4	42.0	7.58	11	— 2.14	2.48	31	209.3
Hanmer	1270	60.2	+ 0.5	86.0	35.6	1.99	11	— 1.54	0.86	17	214.8
Christchurch ..	22	63.6	+ 2.2	91.7	41.6	1.04	10	— 1.19	0.22	16	249.2
Ashburton	323	63.2	+ 2.2	93.0	39.8	0.89	6	— 1.74	0.43	22	215.6
Timaru	56	62.1	+ 0.5	90.8	38.1	1.04	8	— 1.33	0.24	20	209.1
Alexandra	520	63.8	+ 2.1	84.9	43.5	1.58	10	— 0.26	0.57	20	224.5
Taieri	80	59.2	+ 1.4	87.4	36.6	3.92	15	+ 1.54	1.37	10	180.3
Invercargill airfield	0	56.8	+ 0.6	79.4	38.8	5.59	21	+ 1.86	1.69	3	189.3

Confusion of Terms Used in Fertiliser Sales

A LONG ton net (2240lb.) is the unit normally used and generally understood as a ton in New Zealand, but a number of variants are being used by fertiliser suppliers on the invoice certificates which they are required under the Fertilisers Act 1927 to provide with every sale of a lot of more than 5cwt.

With some imported fertilisers, particularly nitrogenous materials of European origin, the weight is declared in metric tons, which are of about 2204lb. or 36lb. less than a long ton. Some suppliers quote "gross for net" on a transaction in which either a long ton of 2240lb. or a metric ton of 2204lb. includes the weight of the bags. A metric ton "gross for net" may mean only 2159lb. of fertiliser, that is, 2204lb. less 20 bags at 2¼lb. each or 81lb. less than a normal long ton net. At £30 per ton this difference would represent about 21s. 8d. per ton.

Any farmer in doubt about the method of measurement used should discuss it with his fertiliser supplier.

Show Dates

THE following are the dates and venues of A. and P. shows:—

April

*2 April—Oxford A. and P. at Oxford.

11 April—Mackenzie County A. and P. at Fairlie.

11 April—Strath-Taieri A. and P. at Middlemarch.

16 April—Malvern A. and P. at Sheffield.

Winter Shows

*31 May, 1, 2, 3, 4, 6, and 7 June—Waikato A. and P. at Hamilton.

8, 9, 10, and 11 June—Whakatane A. and P. at Whakatane.

15, 16, 17, and 18 June—Taranaki A. and P. at New Plymouth.

16, 17, and 18 June—Te Kuiti and District A. and P. at Te Kuiti.

* The Department of Agriculture exhibit will be staged at this show.

Provision of Drinking Water for Pigs

THE question is often asked whether pigs should be supplied with fresh drinking water or not, and as there seems to be some difference of opinion, the question is discussed in this article by I. H. Owtram, Extension Officer in Pig Husbandry, Department of Agriculture, Wellington.

WHEN pigs are being fed almost entirely on meal as they are in Great Britain and other European countries provision of fresh drinking water is standard. Generally this is done by automatic drinking bowls of very similar design to those used for dairy cattle and which ensure that a supply of clean drinking water is always before the pigs. In Denmark, however, it is considered that slightly better food conversion is obtained by restricting the amount of water drunk by the pigs, and it is accordingly rationed to rather less than ½ gallon per pig per day to pigs of 40lb. liveweight, and up to 1 gallon per pig per day to pigs of bacon weight.

New Zealand Practice

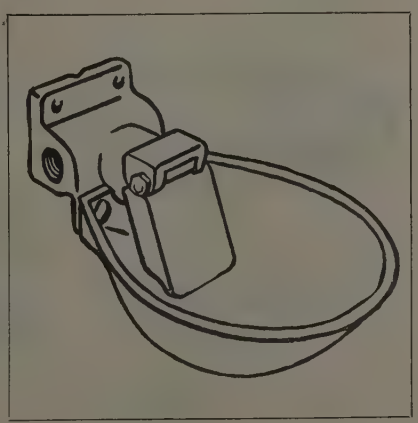
In New Zealand very few pigs, if any, are fed on meal only, but quite a number are fed on garbage or kitchen waste and with this food a good supply of drinking water is necessary and should always be provided. This is particularly important for in-pig sows and sows that are suckling a litter, if they are to produce plenty of milk.

However, the great majority of pigs in the Dominion are fed almost entirely on skimmed milk or whey and so receive practically the whole of their food in liquid form. Skimmed milk and whey both consist of over 90 per cent. of water and the average quantities consumed per day by pigs are as follows (the quantities should be divided by 10 to give the amount in gallons):—

Pigs of 40lb. liveweight (weaners): 18lb. of skimmed milk or 25lb. of whey.

Pigs of 100lb. liveweight: 36lb. of skimmed milk or 50lb. of whey.

Farrowing houses should be fitted with a water trough (above) or an automatic drinking bowl (below) because for 24 hours before and after farrowing a sow should be very lightly fed (if at all), but should be given plenty of drinking water to enable her to make a good supply of milk.



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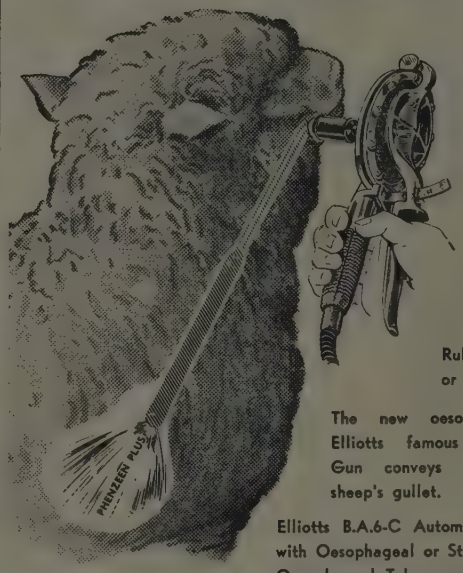

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Dry sows: 60lb. to 70lb. of skimmed milk or 100lb. of whey.

Sows suckling litter: 100lb. to 125lb. of skimmed milk or 220lb. of whey.

Obviously pigs on these foods are getting very large quantities of liquid per day and probably do not require any extra water, though they will often drink it if it is available. Numbers of successful pig producers give no water to pigs being fattened on dairy by-products, but whether this gives the best results in food conversion is not as yet definitely known.

Autumn and Winter Practice

However, there are periods of the year when little if any skimmed milk or whey can be given to pigs, particularly in late autumn and winter, and at these times pigs are often fed on home grown crops or purchased meal. Under these conditions water is important, and clean, fresh water should be provided, as too often at such times pigs are forced to drink out of dirty, contaminated puddles.

Type of Trough

In-pig sows in autumn and early winter, when no dairy by-products are available, should have access to drinking water, which should not be put in cattle troughs, which are too high for pigs to drink from. Farrowing houses should be fitted with a water trough or automatic drinking bowl for two reasons: First, because for 24 hours before and after farrowing a sow should be very lightly fed, if at all, but should be given plenty of drinking water to enable her to make a good supply of milk; second, to fit in the supply of pigs with the supply of skimmed milk or whey on a dairy farm sows should be farrowed in May to June, when very little skimmed milk or whey is available, but the sow must somehow be given sufficient water to keep up her milk supply for the litter, as her food will consist of either home grown crops or meal.

Therefore it would appear that on a dairy farm where skimmed milk or whey is fed water troughs should be provided in farrowing pens, but are not necessary in fattening pens. Paddocks in which dry sows are run should have a water trough of a convenient height for pigs to drink out of and of such a size that the pigs cannot get into it. Pigs fed on garbage only should have clean drinking water available always.

Large Roundworm of Pigs

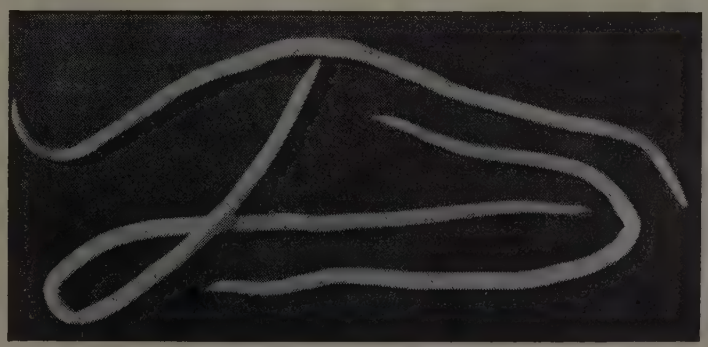
By L. K. WHITTEN, Parasitologist, Department of Agriculture Animal Research Station, Wallaceville

THE large roundworm is a common cause of disease in many pig producing countries in the world. The parasite, which is similar to the large roundworm of man, is a thick creamy-white worm, 6in. to 12in. long. It lives in the small intestine, where the females produce enormous numbers of eggs, which are passed out in the droppings.

UNDER suitable climatic conditions the eggs reach the infective stage in 10 to 14 days, but they hatch only after being swallowed by a susceptible pig. The life cycle is a complicated one in that after hatching, the larvae bore through the gut wall, reach the blood stream, and are carried in it to the lungs. In the lungs the larvae reach the air passages, then the windpipe, and eventually they are swallowed again and grow to maturity in the small intestine.

Symptoms

The symptoms of worm infestation in pigs are mainly those of unthriftiness and slow growth, but coughing is a prominant feature during the stage of lung migration. From time to time infested pigs pass out occasional adult worms spontaneously. On a heavily infested property this would scarcely pass unnoticed by an observant farmer. Unthriftiness and coughing are not sufficient evidence of infestation, as these two symptoms may have a variety of causes. Recognition of the worm itself is the only definite criterion of infestation.



Large roundworms of pigs.

Treatment

The drug most frequently used for treating roundworm infestation is oil of chenopodium, which is usually combined with castor oil and must be dosed to the pigs individually. Over recent years sodium fluoride has become popular and has the advantage that it can be administered to groups of pigs, mixed with their food. It is admirable for use with meal feeding, but unfortunately when it is given with liquid feeds such as skimmed milk or whey there is a greatly increased risk of poisoning from the more rapid absorption that occurs in liquid form.

Incidence of Infestation

Overseas workers have shown that the incidence of the large roundworm is highest in pigs from 2 to 5 months old and also that in this age group the number of worms in infested pigs is also greatest. Recently a survey was carried out in a number of centres throughout New Zealand by Meat Inspectors of the Animal Industry Division of the Department of Agriculture. Only porkers were examined. The incidence of infestation was found to be very low in the North Island, where only 0.1 per cent. of the sample were infested, but was very much higher in the South Island, where 10 per cent. were infested. The incidence for the country as a whole would still be very low, because nearly 90 per cent. of the pig population is in the North Island and also because the figures were obtained from an examination of the age group likely to be most heavily infested.

Routine treatment of pigs is often practised and in some countries has much to recommend it, but from consideration of the figures quoted above it is clear that under New Zealand conditions such a recommendation would be unwise. Though the overall incidence is low, quite likely on some properties roundworms present a real problem and on such places routine treatment may be worth while. Control measures should not be instituted without a definite diagnosis of infestation, as treatment, where it is unnecessary, is costly and not without some risk.

History of Field Crop Experiments in New Zealand

By JEAN G. MILLER, Biometrician,
Department of Agriculture, Wellington

BECAUSE there could be no traditional peasant farmer class in New Zealand, with centuries old customs of tilling the soil, and because whenever they began to break in their land the pioneers immediately met problems unknown in their homeland, there has always been an experimental spirit evident among New Zealand farmers. During last century many farmers, with the staff of Canterbury Agricultural College, Lincoln, and members of the Department of Agriculture, carried out many simple experiments. A new variety or treatment would be introduced to a district and while the crop was growing it would be fully observed. If it "looked good" as judged against the background knowledge of the observer, it would be accepted and recommended to the community.

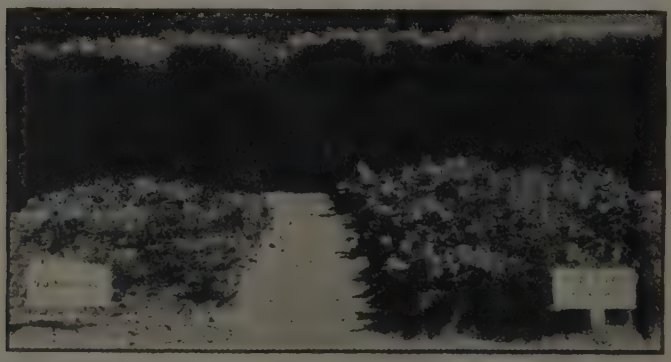
From 1900 onward the Department of Agriculture tested many varieties of all crops in large plots on its experimental stations. These plots of maize were growing well at Weraroa in 1906.

BY the early 1900s the Department of Agriculture on its experiment stations was doing a considerable amount of plant testing, growing say 30 varieties of a crop in single rows or in blocks and getting estimates of yield. Schools were encouraged to make fertiliser comparisons mainly for demonstration to their pupils, but useful information was obtained for recording from these trials. During this period it became the practice to have exactly the same series of plots in several districts, thus obtaining a better over-all picture of the comparison of the varieties. In 1908 the Department's chemist, B. C. Aston, instituted a very valuable series of fertiliser trials in co-operation with farmers. He devised a series of mixtures, had them made up in packages suitable for ¼-acre plots, and made them available to any farmer for £2 a set. Many years later the results from this series, which ran from 1908 to 1916, were collected and analysed all together, thus providing a sound basis for fertiliser recommendations. It is interesting to note that now the Department is again sending out package trials, this time through its instructors and for the purpose of testing minor elements. In those days, when fertilisers were not used as much in farm practice as they have been since, responses to the major elements were often very large, for instance:—

Treatment	Yields of rape in lb. per plot
No manure	48
Basic slag	78
Bonedust	101

Hence these simple trials were able to give fairly reliable information about the best fertiliser to use. In 1911 a standard design was adopted for observational topdressing trials and many readers will no doubt recognise from the diagram on the opposite page that it is fundamentally the same layout as that used extensively today for standard L.P.K. trials.

B. C. Aston, who was appointed chemist to the Department in 1899, began the first comprehensive series of manurial trials on crops from 1908 to 1916. Standard packages of manure mixtures, enough for plots each ¼ acre, were sent to farmers on request.



Primary schools were encouraged by the Department to conduct fertiliser trials. These two plots at Mauriceville West School in 1904 show the effect of manure on rape.

As the use of fertilisers increased and the best varieties were sorted out responses and differences in trials became smaller; simple trials alone were gradually proving of less use. Since soils and plants vary so much, even over short distances, a small difference in the yields of two plots can be due just as much to natural fertility differences as to the effect of the treatments applied. Thus simple trials do not always give the correct

answer. Between 1910 and 1920 the practice grew of including more than one control plot in each trial, until finally every alternate plot became a control. This design certainly gives good estimates of the effect of each treatment compared with control, but is inefficient because half the trial area and half the work are used in testing out the control or the standard variety about which much is known already. During this decade in England replicated experiments (that is, with several plots of each variety under test) were regularly used in some of the research stations, but there were also many organisations in England and other parts of the world which like New Zealand had not really progressed beyond the simple experiments.

First Steps

In 1920 a new layout and method of analysis of results were used. This was first recorded in a pasture topdressing trial with "radio-active" material at Motuihi Island. (This material was a proprietary fertiliser of phosphate, lime, and Taupiri coaldust which it was claimed contained radio-active material.) The layout featured a control plot at intervals but not beside every treated plot. This allowed the use of a new method of "adjusting" the yields to obtain better accuracy. A kind of fertility index was worked out for each plot position, based on the yields of the two nearest control plots. Then the actual yield was compared with this fertility index to obtain the true percentage increase due to the treatment on that plot.

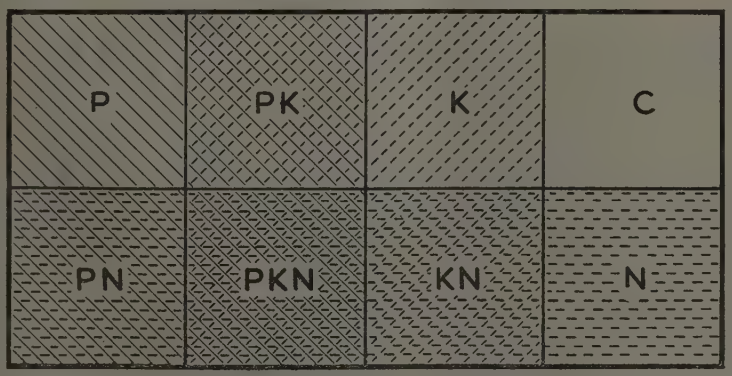
The first truly replicated trial by the Department of Agriculture (and it is unlikely that there were any similar experiments outside the Department) was laid down in August 1921, surprisingly on pasture, which is a much more difficult subject for experiments than annual crops. There were 18 plots, 3 replicates of 6 treatments, each plot being 5 chain by ⅔ chain, which makes a very large experiment by modern standards. In the analysis of this experiment there is evidence of an awareness of "experimental error". This does not mean that mistakes were made in the experiment, but refers to the variability inherent in all experimental results because of the variation which naturally exists in all plant material and all soil. In this trial, however, no attempt was made to measure its probable size or its effect on treatment comparisons.

At this time the only results which were secured from pasture trials were stock grazing figures, which can be very unreliable, or hay weights, which represent the growth of grass during only part of the season.

Radical Change

In 1923 came a notable advance in experimental method. The significant experiment was carried out at Lincoln College, and it was on harvesting methods of wheat to test shaking liability. Five different treatments were compared, each one being repeated 31 times to give a total of 155 plots, which were harvested by hand. In the report of this trial in "The Journal of Agriculture" F. W. Hilgendorf and J. W. Calder show how they calculated the "probable error" for each mean, and in drawing their conclusions from the trial they took account of these errors. Some of the treatments differed from the standard by amounts which were only equal to the "errors" and in these there was no "real" difference due to the treatment. This method of analysis of a fully replicated trial, with its test for the "validity" of apparent treatment differences, had been devised by W. S. Gosset or "Student", in England in 1908. From 1923 onward it was fully used in New Zealand for almost all field trials. Since the "package trials" of B. C. Aston, much earlier, had been virtually replicated by having the same set of treatments on many farms, Hilgendorf was able to apply this method of analysis to the results of those old trials and of several other series.

Before certification schemes were established there was a multitude of varieties of each crop to be tested, but probably many of these so-called varieties were strains of a few varieties only. In the Ruakura potato trial of 1914 there were 140 plots, each containing a different named variety.



In 1911 a standard design was adopted for topdressing trials which farmers were encouraged to use for their own information. This pattern is similar to that which is still widely used for the standard L.P.K. topdressing trials. C—Control. P—Superphosphate. K—Kainit (potash). N—Nitrogen.

New Patterns

This work by Hilgendorf stimulated other workers both in the field and in the laboratory to plan their experiments according to the most up-to-date scientific principles and to analyse their results critically. All wheat trials were laid out in the Beavan drill strips method, where the plots of two varieties A and B are laid out in the order ABBAABBA and so on. The Department of Agriculture had

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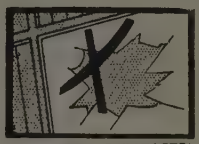

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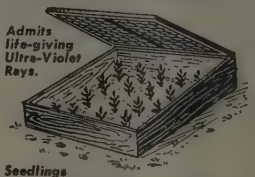

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To give more accurate comparisons of treatment effects every second plot was made a control in many trials before 1920. This is wasteful of land and labour.

manurial trials with potatoes in Canterbury where the treatments were:—

1. Superphosphate
2. Control
3. Bonedust + superphosphate
4. Bonedust + superphosphate + potash
5. Control
6. Bonedust + superphosphate + potash + sulphate of ammonia

The order of the plots was 123456, 123456, . . . for 4 replicates. These results were analysed by "Student's" test.

On these plans, then, and with this statistical test all the experiments carried out by the Department of Agriculture and Lincoln College, the only two organisations conducting field research, were carried out for several years. The Cawthron Institute had been established in 1921, but during its first few years of existence had done few field trials.

Administrative Changes

However, in 1928 two administrative changes influenced the future pattern. A Crop Experimentalists section was set up in the Department of Agriculture under A. W. Hudson, who had been conducting experiments for some years, and the Wheat Research Institute

The first trial where all treatments were repeated an equal number of times was laid down on pasture on the farm of Mr. C. Harrison at Te Kumi, 2 miles from Te Kuiti, in August 1921. This photograph was taken just after the plots were cut for hay in January 1922.

was formed under Dr. Hilgendorf. For the next decade the spirit of these two men dominated the methods of field experiments in this country. The first appointment meant a co-ordination and extension of the work of the Department to more ambitious crop trials and a real attack on the problems of pasture trials. The beginning of the Wheat Research Institute meant that there was need to test accurately large numbers of selections from cross-bred material with small quantities of seed, and this later led to the adoption of more advanced techniques.

Progress in Pasture Trials

Up to 1928 all pasture trials were of the unsatisfactory haying or grazing type, which did not give a reliable estimate of the production available for the stock to eat throughout the year. About 1925 workers in England were anxious to use the lawnmower to measure this, but had met difficulties due to the pasture becoming a lawn, with the more rapid depletion of the better growing plots. In 1928 Hudson showed that a trial could be run successfully under a mowing and grazing technique whereby there are two sections, one of which is being mown for production estimates while the other is grazed by sheep, then vice versa. This opened the way for pasture investigations to be conducted on small plots which could be replicated

The drill strip method was introduced in 1925 because it allowed statistical analysis of the results. Two treatments A and B are compared in a series of plots running ABBAABBA and so on. Many of these trials were conducted by J. W. Hadfield, who is shown in the photograph.

FIELD CROP EXPERIMENTS IN NEW ZEALAND

Upper left—In manurial trials with wheat the difference due to phosphate application was often striking. In this photograph, taken in 1924, F. E. Ward (left) and A. H. Cockayne compare a plot which had received 1cwt. of superphosphate per acre (left) with one which had received no manure. Upper right—A haying trial. Before 1928 the only data available from pasture trials were stock grazing days or hay weights, which represent growth over part of the season only. This haying trial shows the large plots which were necessary. Middle left—A mowing trial. The modern pasture trial technique of measuring production by mowing small plots was successfully developed at Marton. Two areas are used alternately, one being grazed while the other is growing to be mown and weighed. Clippings are returned to the plots to help maintain fertility while there is no grazing. Middle right—When A. W. Hudson began experiments in the Department of Agriculture in 1925 he introduced improvements in technique to obtain greater accuracy. He believed that the smallest experimental errors came from layouts of a systematic type as shown in the upper diagram on the opposite page. Lower left—E. B. (now Sir Bruce) Levy, A. W. Hudson, Lord Bledisloe (then Governor-General), and W. B. Wards at one of the early small-plot pasture trials at Marton.

1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Superphosphate	Control	Bonedust & super	B/dust & super & potash	Control	B/dust & super & pot & s/amm.																		

From 1924 many trials were laid down with several replicates or repeats of each treatment, plots being arranged in a systematic pattern as in the above diagram of a potato manurial trial. Dr. F. W. Hilgendorf (at right), of Canterbury Agricultural College, Lincoln, was responsible for the introduction of these trials with statistical analysis to measure their accuracy. Green and Hahn photo.

and set out in good designs. Many trials of this type have since been carried out in this country and overseas.

Studies in Designs

Both Hilgendorf and Hudson were interested in the statistical approach to experiments and were keen to use new methods to obtain the most information out of all trials. This led Hudson to the idea that in paired comparison trials where the two treatments were arranged ABABAB it would be possible to get an extra set of comparisons. Normally the treatment difference was obtained by subtracting every A plot (Nos. 1, 3, 5, 7, 9, and 11) from its corresponding B plot to the right (Nos. 2, 4, 6, 8, 10, and 12) and averaging these differences. A second set could be obtained by subtracting the A plots 3, 5, 7, 9, and 11 from the adjacent B plots to the left 2, 4, 6, 8, and 10, thus obtaining 11 comparisons instead of the usual 6 for averaging. However, this idea was judged incorrect by the leading figures in the statistical world overseas who had devised the various methods of testing the reliability of experimental results. But it was of importance in that it formed the beginning of a long and profitable association between the leaders of experimental work in this country and the authors of analytical methods in England. "Student" in particular took a lively interest in the results of New Zealand experiments.

Random Layouts

In his book on "Statistical Methods for Research Workers", which was first

3	5	6	1	2	4	1	3	4	6	2	5	6	2	5	3	4	1	4	5	2	1	6	3
Sulp of ammonia	Serp superphosphate	Serp super. & s/amm	Control	Superphosphate	Super & s/amm																		

When the world argument among statisticians was over, the "randomised" block design was quickly adopted in New Zealand, and has been the basic pattern for all experiments since 1940. Each block contains one plot of each treatment, but in a "random" order, not regularly as in the older method.

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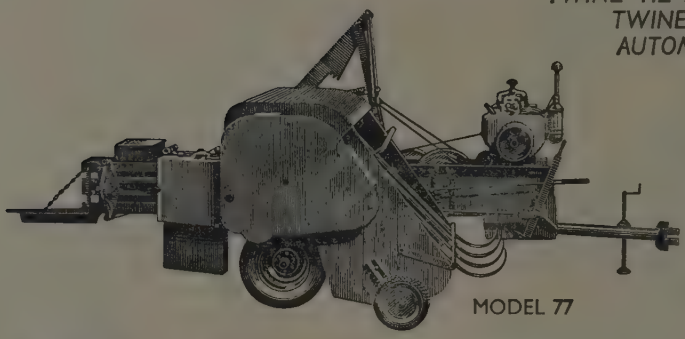

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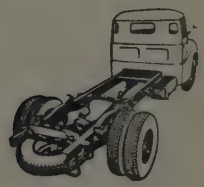

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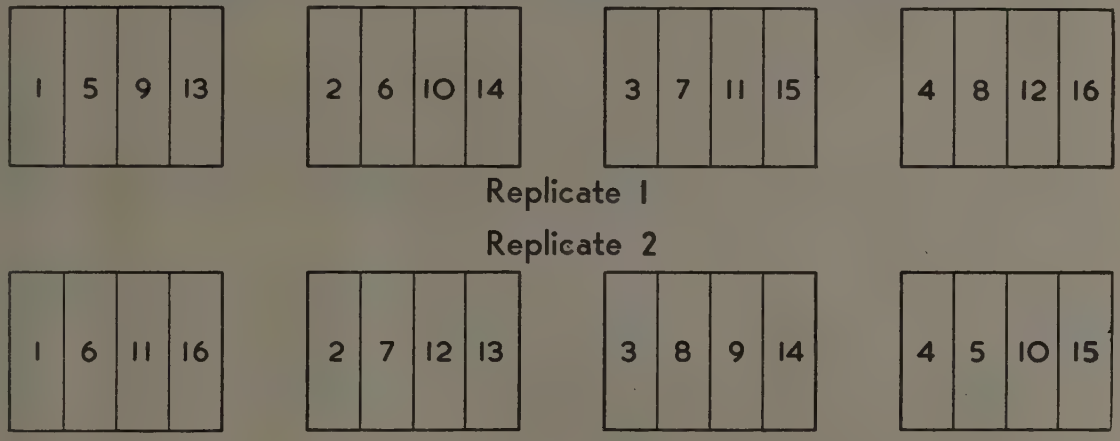

For testing many varieties at once a lattice design is now used, as this system enables any number of varieties from 16 to 216 to be compared. This small, 16-variety plan shows how varieties which are in the same sub-set in the first replicate occur once in each of the sub-sets in the second replicate. From this a fertility index can be calculated for each plot and the effect of soil variation on the actual yields can be allowed for.

published in 1925, R. A. Fisher, of Rothamsted, advocated that in each replicate of an experiment the treatments should occur in a **random** order, not **regularly** as in previous experiments. This split the statistical world and for some 10 years the New Zealand workers were ranged on the side of the systematists, who were led by "Student". Some studies by Hudson on the size of experimental error to be expected were used in "Student's" final controversial paper in 1937. His untimely death the next year left the victory to the randomists, and the younger generation of New Zealand experimenters were not slow to fall into line.

Good Field Work

With this intense interest in the size and occurrence of experimental errors in the different designs, workers in this country paid great attention to detail and accuracy in their work to eliminate any "mistakes" (which are quite different from natural "errors"), and were ever watchful for factors which might affect their results. There can be no doubt of the quality of the field experiments carried out during that period, and it probably compared more than favourably in accuracy and degree of replication with experiments anywhere in the world.

Wheat Research Institute

The other main centre of interest for agricultural experiments in 1930 was the newly established Wheat Research Institute at Lincoln. A comprehensive policy of breeding and selection brought problems in trial technique. For the testing of early generations of a wheat cross rod rows were used (that is, plots of a single row one rod long), and for the next stages, with more seed available, small plots on a chessboard system devised by Dr. E. S. Beavan in England were used. In these chessboards only a few varieties can be tested at once, whereas in the rod rows, where a large number are tested, soil variability can be so great as to mask really good performances by some of the lines.

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Lattice Design

To cope with this problem Dr. F. Yates, of Rothamsted, devised and published in 1936 a new type of design which eventually came to be called a lattice. This word simply refers to the order of the plots in the trial. In this design the whole set of varieties is divided into sub-sets in different ways so that varieties which are close together in one replicate are widely separated in other replicates. A fertility index can be calculated for each little group of plots, thus reducing the effect of soil variability on the results.

Statistician in Agriculture

Only 3 years after the publication of this method, and in spite of the fact that it appeared very complicated at first, a trial of this design was laid down at the Wheat Research Institute, under the guidance of Mr. I. D. Dick, a statistician. This marks the entry of the professional statistician as distinct from the agricultural research worker into the field of designs in New Zealand, though all the designs in use were of course the work of statisticians overseas. Since then all the refinements of the more complicated designs have at least been tried out here. Some have proved suitable to local conditions and have been retained; others have proved unsuitable and after one trial have been discarded. Apart from trying out the latest overseas designs, in the last few years the statisticians in New Zealand have contributed to the production of new designs for special conditions, so that in design this country has now "come of age".

Care of Livestock during April

Contributed by the Animal Research Division

DECEMBER-FARROWED PIGS

LITTERS farrowed in December should be sold as pork. If they are carried on to bacon weights, no milk will be available for the later litters, which will have to be sold cheaply as stores or wintered on expensive concentrates. Available root crops may be fed to sows, but they require supplementing with milk or meat meal.

TUBERCULOSIS IN POULTRY

Tuberculosis not only causes considerable loss in poultry, but it frequently spreads to pigs, with consequent condemnations at the meat works. If this disease is suspected, veterinary aid should be sought with a view to eliminating affected birds.

CARE OF EWES

If rams remain with the ewes for more than 4 weeks, they should be raddled on the brisket so that the late-lambing ewes can be drafted off. Once the ewes are in lamb the level of feeding should be lowered to prevent their becoming too fat. If the rate of stocking is increased during autumn, some paddocks can be shut up and pasture allowed to grow for grazing during the 3 weeks before lambing. These measures will greatly assist in reducing "sleepy sickness", which is most prevalent in fat ewes which are inadequately fed just before lambing. Ewes which are well fed during the month before lambing produce on the average half a pound more wool per head than those which are underfed during this period.

CARE OF LAMBS

If summer and autumn have been wet, lambs are likely to be suffering from worms. Drenching with phenothiazine 2 or 3 times at monthly intervals will help. This applies particularly to the tail of the flock, which should be drafted off for special attention. Feed, however, is the most important consideration. During autumn lambs do best if grazed on pastures which have been allowed to grow to a height of 4in. to 6in. Hay aftermath and clover are very good. If these are not available, the lambs should be distributed thinly over the dairy paddocks or on hill pastures. They should on no account be concentrated in large numbers on short, rapidly growing pastures, especially if these have previously been grazed by ewes and lambs.

PURCHASE OF HERD SIRE

If a new herd sire will be required this year, now is the time to make inquiries. The New Zealand Dairy Board issues a Sire Survey and Merit Register, which gives the production of the daughters of all dairy sires which have been surveyed. Unfortunately very few progeny-tested sires are available, but the Register should be consulted and wherever possible a bull by a proven sire out of a merit cow should be selected. Bull catalogues are issued annually by the Herd Improvement Association and these, too, should prove of considerable value to dairy farmers, who are looking for herd sires. The New Zealand Dairy Board is now developing artificial breeding on a commercial basis and farmers interested in making use of this service should get in touch with their local Herd Improvement Association.

CARE OF CALVES

The best way to prevent calves dying during winter is to treat them properly during autumn. They should never spend more than 2 or 3 days in one paddock, and should be rotated ahead of the cows through the best paddocks available. Good-quality hay should be provided for them daily, especially when the feed is growing fast after autumn rains. Set stocked calves should be drenched with phenothiazine as soon as scouring is noticed.

DRYING OFF DAIRY COWS

A dairy cow requires a reasonable spell between lactations, and should be dried off at least 6 weeks before she is due to calve. This should be done even if she is still milking heavily. The drying-off process need not be prolonged; it is quite safe just to stop milking, provided any quarters affected with mastitis are treated with the usual course of 3 tubes of penicillin, the last tube being given after the cow is milked for the last time.

AUTUMN-SAVED PASTURE

Early-calving cows are nearly always short of feed during July and August, and often during September. In most seasons pasture is not growing fast enough during these months to meet the requirements of milking cows. Crops are expensive to grow and concentrates are even more expensive to buy. It costs nothing, however, to shut up pasture in the middle of April and let it grow for use in early spring. As much as possible of the dairy area should be shut up in this way. Advice regarding the best paddocks to spell and the best method of feeding the autumn-saved pasture by the use of electric fences can be obtained from local officers of the Department of Agriculture.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during January and for the 6 months ended 31 January 1955, with comparative figures for the same month and 6-monthly period of 1954, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Inc. or dec.
January 1955	19,175	384	19,559	—
January 1954	17,946	368	18,314	—
Increase or decrease ..	+1,229	+16	+1,245	+6.798
6 months ended 31/1/55	112,127	2,081	114,208	—
6 months ended 31/1/54	109,789	2,082	111,871	—
Increase or decrease ..	+2,338	—1	+2,337	+2.089

Butter in store at 31 January 1955 was 40,900 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
January 1955	10,759	1,658	12,417	—
January 1954	12,623	39	12,662	—
Increase or decrease ..	—1,864	+1,619	—245	—1.934
6 months ended 31/1/55	53,634	13,714	67,348	—
6 months ended 31/1/54	64,951	98	65,049	—
Increase or decrease ..	—11,317	+13,616	+2,299	+3.534

Cheese in store at 31 January 1955 was 34,100 tons

If these figures are converted into butterfat equivalent, there is an increase of 2.389 per cent. in butterfat graded for the 6 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

Crop Production and Pasture Management

Seasonal Notes by the Extension Division

EVEN with general dependence on pastures for the production of meat, wool, and dairy produce the growing of annual crops is still important on many farms. Whether the cropping schedule entails only the production of an area of soft turnips for the summer supplementary feeding of dairy cows as a stage in pasture renewal or a full range of cash and fodder crops on an arable farm, consideration should now be given to the work programme envisaged for next cropping season.

CROPPING PROGRAMMES

THE first essential in a cropping programme is to arrange the sequence of crops so that at the completion of the period the land is sown to pasture under the most favourable conditions, and in most districts this entails early-autumn sowing. Other points to be considered are: Seasonal requirements of supplementary fodder for livestock and in suitable areas the integration of cash crops in the rotation with fodder crops; the choice of varieties best suited to local soils and climate; the optimum sowing times and fertiliser requirements for each crop or variety; and the seasonal distribution of cultivation work so that seed-beds may be prepared in suitable condition and at appropriate times for sowing.

—A. R. DINGWALL

* * *

WHEAT AND OATS

WHEAT and oats are similar in that over the last 20 years they have decreased steadily in area, but both may still be regarded as reliable and profitable cash crops. They may both be grown on quite a wide range of soils, but for cash cropping on soils of lower fertility oats are definitely preferable to wheat, which requires for successful growing a medium to high standard of fertility. The treatment and preparation of land for autumn-sown wheat and oats are similar. It is not necessary to work land too fine and it is better to have it rubbly on top. Except on soils of very high fertility it is desirable to use 1cwt. of superphosphate when sowing either crop. The main milling oat varieties, Abundance and Onwards, may be autumn or spring sown. They can be used for greenfeed also, but the most useful dual-purpose varieties are Algerians and Duns, which recover well after grazing and may be used as a crop for chaff or grain. Grey Winter is another useful greenfeed variety that can be used as a crop. Other varieties include Russet, Milford, and Achilles. Black Supreme and Black Tartar are probably the most common of the black oats usually grown under cooler climatic conditions at higher altitudes. The autumn varieties of wheat are mainly Cross 7 on medium to heavy soils, Hilgendorf on medium to medium-heavy soils, Fife Tuscan and Yielder on medium to light soils, and Dreadnought and Hunters on heavy soils.

—P. R. BARRER

* * *

YOUNG PASTURES

THE management of a young pasture in its early life will largely influence its future productivity. Many good strikes of young grass are ruined through bad grazing management. The clovers, an essential part of any good pasture, are either eaten out by close and continuous grazing or are smothered through the grasses getting away. The grasses themselves are in severe competition with each other, and the slower establishing species can be choked out if the top growth of the quicker growers is not kept down.

Early grazing of young pasture is important, but the first grazing should not take place until the grasses are about 4in. to 5in. high, as this allows the grasses to become firmly rooted. Surface consolidation by early stocking with the development of strongly rooted grasses and clovers is particularly necessary to prevent frost lift. It also encourages the young plants to stool out rapidly and give good ground coverage which results in a much reduced weed infestation.

New pastures should not be allowed to grow longer than 4in. or 5in. until the clovers are well established. Initial grazings should aim to give a quick, even feeding off. A large mob of sheep is ideal for this, but where dairy cattle only are available young stock should be used. On no account should the grass be allowed to become too long, and it pays to graze even under wet conditions to prevent this happening. Grazing when ground conditions are wet is best avoided, however, to prevent pugging.

Alternate grazing and spelling will maintain the new pasture in vigorous condition through winter and will give all species a chance to establish. Closing for hay and silage crops should be avoided in the first season, as this smothers the clovers, which results in poor subsequent growth as well as leaving bare patches open to weed infestation. New pastures frequently respond to extra dressings of phosphate in the first year of establishment and, on poor soils in particular, this should be applied at 2cwt. to 3cwt. per acre in spring with a similar dressing the following autumn.

—J. A. GRAHAM

* * *

OVERSOWING DAIRY PASTURES

THE oversowing of sub-standard dairy pastures is recommended only under certain conditions. First, it must be ascertained that the reason for the pasture being sub-standard is not due to a nutrient deficiency or low fertility. If this is so, the condition must be corrected, because if old-established plants cannot thrive, newly sown higher fertility demanding plants cannot be expected to thrive under the same conditions. Secondly, oversowing is recommended only where the more certain practice of ploughing and regrassing is not practical.

Oversowing is carried out mainly in autumn and early winter. The pasture should be eaten down hard and lightly disced with little cut on the discs or harrowed severely to produce in either case a light covering of loose earth over the area. After sowing harrowing is essential to cover the seed with loose earth. It has been found in practice that the more severe cultivation is the better the strike will be. Up to 15lb. per acre of either short-rotation or perennial ryegrass can be sown and it is not worth while sowing less than 5lb. per acre. Similarly, it is not necessary to oversow more than 2lb. of clover per acre. However, white clover can be oversown fairly successfully when mixed with the topdressing without prior cultivation. In early spring paddocks cut up through heavy wintering or poaching can be oversown with short-rotation ryegrass, perennial ryegrass, and red clover.

—N. A. CLARKE

* * *

AUTUMN-SAVED PASTURE

IT is now time to give consideration to closing fields for saving late-autumn and early-winter growth of grass for late-winter and early-spring feeding on dairy farms. Times for closing will vary depending on district and seasonal growing conditions, but general practice is to close fields in rotation from late April to mid-June. It is best to anticipate poor rather than good growing conditions in late May and June and endeavour to close some fields fairly early; if growing conditions happen to be good, the early closed fields should be quickly and lightly grazed and closed again. Fields for closing should have a high percentage of perennial or short-rotation ryegrass and should be evenly grazed and harrowed before being closed. In most seasons it is necessary to start supplementary feeding early in autumn to allow fields to be taken out of the grazing rotation and shut up for saved pasture.

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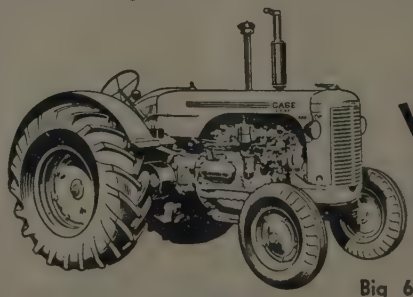

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Autumn Management of Bee Colonies

Seasonal Notes for the Domestic Beekeeper

WITH the removal and processing of the honey crop completed some beekeepers may feel that they have done their part and that the bees can now safely be left to their own devices until spring. Good sound autumn management is essential to successful wintering, however, and care and attention in autumn largely determine the measure of success in the following season. In this article D. Roberts, Apiary Instructor, Department of Agriculture, Auckland, discusses precautions to be observed if colonies are to emerge from the winter vigorous and healthy.

A well-managed apiary in good condition for wintering. The hive floors are raised above ground and the entrances and hive bodies have been kept clear of growth.

ONE of the most important considerations in preparation of the bee colony for wintering is the condition of the queen. The ideal queen is one which is a vigorous layer and which continues a high rate of egg production well into autumn, thus providing a strong population of young bees for winter. The greater the force of young bees in late autumn the better will the colony be able to survive the rigours of winter and to rear brood in late winter and early spring. Given adequate supplies of honey and pollen such colonies, provided there are no accidents, should enter the following spring in the best of condition and with proper management should reach the honey flow in optimum condition for the gathering of the maximum possible crop. One of the first essentials, therefore, is to check the condition of the queen as early in autumn as possible, and where any doubt of her capabilities exists she should be replaced immediately.

It is also most important to ensure that the colony has ample stores of honey and pollen. In the comparatively mild climate of New Zealand a series of unexpectedly warm winter days is not unusual, and the accompanying activity and expansion of brood rearing in the hive in some districts will create a demand on the colony's food supply which may be great enough to cause a risk of subsequent loss through starvation unless adequate reserves have been provided. With normal strong colonies not less than 50lb. to 60lb. of honey should be left for the bees.

In addition there must be a reserve of pollen, and this should be at least the equivalent of a full brood comb. If at first glance insufficient pollen appears to be stored, it should be remembered that when storing pollen toward the end of the season the bees seldom fill the cells more than three-quarters full and they then cover the pollen with honey and finally cap it over with wax. If the combs are held against light the opaque pollen cells will be easily seen and the amount available can be judged accordingly. When the amount of honey to be left is being gauged a reasonably accurate estimate can be obtained if each full brood comb is considered as holding 5lb. of honey.

When selecting honey to be retained for winter stores it is advisable to choose that which has been stored in older brood combs. The bees prefer dark, tough combs for wintering and will at times entirely neglect honey stored in freshly drawn combs. When 50lb. or more of honey is kept colonies will need to be wintered in at least two supers. The combs of honey should be stored in the upper super and the brood should be placed in the lower one. Combs containing both honey and pollen are placed alongside the brood nest. When honey is being arranged in the upper super the centre combs should be those with some empty cells in the lower central portions. This space will be utilised by the queen, and in very cold weather the bees will then automatically be drawn into contact with the food above them.

At this time all supers, lids, and bottom boards should be checked over and any damaged or leaky ones repaired or replaced.

Bees are particularly susceptible to the effects of dampness, and though it is necessary for hives to be weatherproof at all times, it is of particular importance in winter. Bees

An oversheltered and overgrown apiary site. In such conditions dampness in hives is likely to be excessive throughout the greater part of the year and losses in bees and hive material will be heavy.

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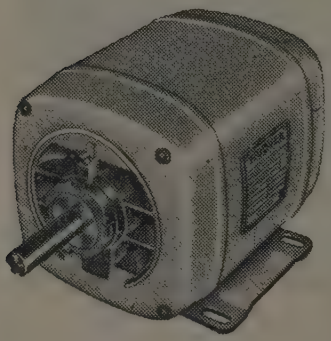

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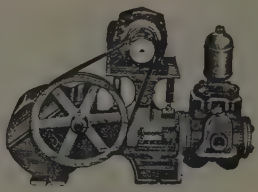

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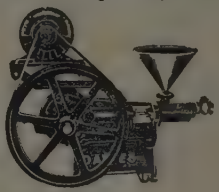

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A young, vigorous queen (left) compared with an old queen (right). Note the worn wings and smooth, shiny body of the old queen.

can stand considerable cold provided they are dry, but a combination of damp housing and cold can quickly cause heavy mortality and, if not remedied, the complete loss of the colony.

Dampness should be avoided at all costs, and if the colony has shown continuing evidence of moisture in the hive, a drier site should be sought. Bottom boards which are in contact with the ground or not more than an inch or so above it should be raised by blocks to give at least 6in. clearance. During winter bottom boards should be given a slope toward the entrance by the backs being raised by ½in. to 1in. This will allow any water which enters during heavy rain to drain out immediately. The hives should be cleared of any surrounding growth of grass or weeds so that they receive the maximum possible sunshine.

Hive entrances should be reduced to a depth or not more than ⅜in. Where standard reversible bottom boards are in use this simply means turning the board so that the side fitted with the narrow fillets is upward. Where other than reversible boards are in use the entrance, if too wide, can be reduced by fitting a strip of wood cut to give ⅜in. clearance across the entrance. The reduction of entrances to not more than ⅜in. will also help to prevent the entry of mice. Mice can cause much loss during winter through their habits of destroying empty or pollen-bearing combs and of building their nests in vacant frames. They favour beehives where the bees are clustered and there is vacant comb space at the sides of the cluster.

Because of the high average percentage of relative atmospheric humidity in many parts of New Zealand it may be found that hives, though weatherproof and clear of surrounding growth, are still continually moist internally. This can usually be overcome by providing the hive with some system of top ventilation. The provision of a 1in. diameter entrance hole in the upper part of the top super is a common practice in overseas countries where the moisture problem is serious. Increased ventilation can also be provided by fitting two ½in. thick strips of wood across the inside of the hive lid so that the lid does not sit closely on the top edge of the super. The hive mat, if mats are used, is cut to to provide a ½in. clearance at each end. This will allow the warm, moist air exhaled by the colony to find its way up over the mat and escape under the lid, thus preventing undue condensation. Bees remove excess moisture from honey by controlling air movement, and, if given the opportunity through the provision of good ventilation, can keep the hive dry even under very wet conditions.

Depredations of Wasps

Since the widespread establishment of the European ground wasp (*Vespula germanica*) in New Zealand there have been reports of hive losses in some districts through their depredations. Wasps are generally troublesome in early autumn to winter, when the wasp colonies are breaking up. They are particularly attracted to sweets, including honey, and will force their way into weak colonies or those with badly fitting supers and lids and consume the honey to such an extent that some colonies perish from starvation. Wasps are individually much stronger than honey bees, and where they are likely to be prevalent only vigorous colonies of good strength which are housed in properly fitting hives should be kept for wintering. Where wasps are seen trying to force entry the hive entrances should be reduced to not more than 6in. x ⅜in.

Wasps remain active in much lower temperatures than do bees and will persist in their efforts to rob when the bees are inclined to cluster. The only effective means of controlling wasps is by destroying their nests, and where they are seen to be plentiful every effort should be made to locate the nest as soon as their presence is noted. Nests should be destroyed as early in summer as possible so that the wasps are not given the opportunity to raise queens, which will perpetuate the nuisance. Destruction of the nests is not usually difficult, and a leaflet describing methods is obtainable on application from any office of the Department of Agriculture.

A hive almost entirely overgrown with fern, gorse, and blackberry. A hive in this condition will be weakened and will probably swarm away and die out.

The Mount Fuji Flowering Cherry

By F. E. WILKIN, Plant Quarantine Officer,
Department of Agriculture, Wellington

THE lovely pure white Japanese flowering cherry illustrated at right is usually known in New Zealand as Mount Fuji; there are many other names for this beautiful tree, one of the most common being Kojima. In classified descriptions of flowering cherries it is usually designated Shirotae, which is its horticultural variety name in the large *Prunus lannesiana* group of cultivated kinds. It seems likely, however, that Mount Fuji is really a variety derived from the Oshima cherry *Prunus speciosa*, a native of Japan.

MOUNT FUJI is one of the loveliest of all the flowering cherries. It has large pendant trusses of fragrant, big double flowers of an unusually pure white and so, abundantly is its white blossom produced in spring that the Japanese names for the plant compare the blossom with snow. In New Zealand it flowers during September and October in most districts.

The leaves are soft green and are fringed with fine, comb-like serrations; the autumn tints are golden yellow. The tree is hardy in most parts of New Zealand and may eventually reach a height of 20ft. or more. Because of its spreading, umbrella-like habit of growth it makes an ideal sunshade tree for a lawn. Wherever it is planted enough space should be left clear about it for proper development of the branches. A position should be chosen which will allow the tree's beauty of form and blossom to be seen and admired freely and which will provide shelter from winds as well.

As flowering cherries are usually grafted or budded on to stocks of various types, propagation is best left to a reputable nurseryman. When a tree is being chosen in the nursery one that has been pruned so that it will produce a leading shoot should be selected.

Good Drainage Essential

In the selection of a site for the tree the first essential is good drainage. It will grow in almost any soil, but prefers rich soils, particularly those of a well-drained, alluvial type.

The ground should be thoroughly prepared for the reception of the plant well in advance of planting so that the soil is in good tilth and has settled sufficiently. This is essential for the vigorous development of the roots so necessary to the health and growth of young trees.

About 2oz. of bonedust may be worked into the soil some weeks before the tree is planted. In no circumstances, however, should manure or fertilisers be allowed to come in contact with the roots or stem at time of planting.

A hole dug in a lawn or uncultivated ground, particularly in heavy soil, without adequate drainage may become a sump for water in wet weather; this will cause growth stagnation or even the death of a tree planted in it.

The Mount Fuji flowering cherry.

When soil conditions are suitable a circular hole should be dug large enough for the reception of the roots without their being overcrowded or bent. Before the tree is planted the roots and branches should be examined and any damaged or broken portions should be trimmed off cleanly with a sharp knife. A tree, particularly a cherry, should not be planted more deeply than the depth at which it was growing in the nursery. This can usually be determined by the soil mark on the stem. After planting, the soil should be firmed well, and, if necessary, the tree staked and a narrow piece of sacking wrapped round the stem to prevent the tying material cutting into the bark.

The best time to plant is late autumn or early winter, but planting may be done any time in winter or early spring. A mulch of well-rotted manure or compost about 2in. thick spread well round the plant but not heaped about the stem helps to prevent the soil drying out and will add humus to the soil. If sawdust is used as a mulch, it is improved by the addition of 3oz. or 4oz. of nitrogenous fertiliser such as blood and bone or sulphate of ammonia to each tree, as this will cause it to rot more quickly. Unrotted sawdust should not be mixed in with the soil round the tree because it may rob it of nitrates, though it is quite safe if used as a surface dressing.

The ground beneath a young tree should not be allowed to become turf bound, as this condition prevents water from penetrating the soil and inhibits the growth of the tree.

Training the Tree

As a young tree grows the leading shoot should be trained to secure a main stem. The lower branches may be shortened back to suitable buds and those not required or likely to cause overcrowding may be removed. Sufficient wood should be retained, however, to provide the tree with ample foliage, as this is essential to its health and vigour.

When the main stem has reached the required height, usually somewhat more than 4ft. or 5ft., the upper branches may be allowed to develop in their natural horizontal fashion and the lower branches may be removed flush with the trunk as the foliage carried by the top branches becomes adequate for the size of the tree. The lower branches are best removed a few at a time over a period.

Once the desired shape has been attained pruning should be light and more or less restricted to training and thinning out overcrowded, dead, or unhealthy wood to develop the natural spreading habit of the tree.

Pruning is best done as soon as blossoming is over. Heavy pruning is likely to cause gumming in cherries and therefore should be avoided if possible.

All pruning should be done either near a desirable bud or close up to a branch or lateral so that the cuts will eventually callus over and prevent the entry of wood-rotting organisms. A wise precaution is to cover all wounds of ¼in. or more with bituminous paint, as this assists callusing and helps to prevent the entry of disease organisms such as silver leaf (*Stereum purpureum*), a fungous disease whose spores may enter through even the smallest wound.

Poultry Flock Improvement Plan: Data on Average Egg Production and Poultry Losses

IN 1953 the conditions of the New Zealand Poultry Flock Improvement Plan were expanded and a section was started under which accredited breeders are required to record the egg production of a proportion of their pullets. The first year's results of this section of the plan were published in June of last year. In this article F. C. Bobby, Superintendent, Poultry Industry, Department of Agriculture, Wellington, records the results obtained in the second year of this egg recording section.

THERE are three main requirements under the egg recording section of the New Zealand Poultry Flock Improvement Plan, and these may be summarised briefly as follows: First, the sample flock of pullets recorded for egg production must represent not less than 12½ per cent. of the total laying birds of the breed involved; second, daily egg totals for a sample flock must be recorded on the sheets provided over a stated period; and third, once the recording period starts no birds may be added to the flock, though culls may be removed.

Change in Conditions

There has been only one change in the original 1953 conditions. For 1954 the period of egg recording was reduced to 8 months, starting on 1 March and ending on 31 October. In 1953 the period was fixed at 10 months, but at the end of the season a number of breeders stated that they met practical management difficulties in maintaining their flocks of pullets untouched for 10 months. In most cases these breeders wished to amalgamate a number of pens of pullets, after culling toward the end of the year, to get housing cleaned and ready for penning new season pullets. Though the Dominion Committee of the Poultry Flock Improvement Plan was not in favour of reducing the period of egg recording, it did so because it was realised that the conditions of the plan must fit in with the practical management policy adopted by the majority of the accredited breeders supporting the plan. Thus in this report it will not be possible to make direct comparisons of the results obtained in 1954 with those of 1953. Adjusted figures for 1953 will be used so that reasonable comparisons may be made. This difficulty will not arise in future years, as the period for egg recording has now been stabilised at 8 months.

Greater Support Required

The most disappointing aspect of this section of the plan is the limited support that it has received and the reduction of flocks recorded in 1954 as compared with the number in the previous year. For some years before 1953 it was strongly contended that the plan should take cognisance of egg production, and yet when this is done in a most simple manner, designed particularly to meet New Zealand poultry farming conditions, the support hoped for has been only partly obtained. The work involved by the conditions laid down is a minimum and certainly no greater than that any sound poultry breeder should be carrying out irrespective of any flock improvement plan. A strong plea is made by the Dominion Committee for greater support to be accorded to this section of the plan, similar to the satisfactory support being given to the plan as a whole.

Results in 1954

Twenty-seven accredited poultry breeders egg-recorded pullets for 8 months in 1954. A summary by breed and islands of these flocks is as follows (1953 figures are in parentheses):—

	Flocks	Pullets recorded
North Island		
White Leghorns	10 (14)	1,398 (1,859)
Australorps ..	9 (7)	1,387 (1,200)
South Island		
White Leghorns	6 (8)	880 (1,160)
Australorps ..	2 (2)	125 (140)
	27	3,790

In addition to the above flocks, which completed the egg recording period, 12 other accredited breeders applied for accreditation under this section and started recording their pullets, but for various reasons were unable to complete the full period.

Table 1 sets out the average egg production per pullet for each of the 8 months—March to October—in which the birds were egg recorded. These figures are assessed on a flock-housed average basis (that is, total eggs laid divided by the number of birds housed at the start) and refer to all 27 flocks recorded. Comparable figures for 1953 are shown underneath. The total laid per pullet for the 8 months was greater in 1954 than in 1953 for both breeds, probably owing to seasonal conditions. As in 1953 the

HEADING PHOTOGRAPH: Outstandingly good housing for laying pullets on the farm of an accredited breeder in Hawkes Bay.

TABLE 1—DOMINION FLOCK-HOUSED AVERAGE EGG PRODUCTION FOR WHITE LEGHORNS AND AUSTRALORPS

		March	April	May	June	July	August	Sept.	Oct.	Total eggs 8 months
White Leghorns (2,278 birds)										
Eggs per pullet	1954	14.5	14.2	13.2	11.9	13.4	17.1	17.7	18.0	120.0
	1953	12.9	12.4	14.0	13.1	14.0	16.0	16.5	16.2	115.1
Australorps (1,512 birds)										
Eggs per pullet	1954	15.0	15.9	16.4	15.4	16.5	18.7	18.6	17.6	134.1
	1953	16.1	15.6	16.5	16.2	15.7	16.7	17.5	17.2	131.5

TABLE 2—WHITE LEGHORN EGG PRODUCTION IN NORTH AND SOUTH ISLANDS

North Island (1,398 birds)										
Eggs per pullet	1954	15.1	14.8	13.4	12.1	13.8	17.9	18.8	19.0	124.9
	1953	12.8	12.3	13.5	13.0	13.7	15.7	15.9	15.9	112.8
South Island (880 birds)										
Eggs per pullet	1954	13.5	13.2	13.0	11.7	12.7	15.9	16.1	16.3	112.4
	1953	13.2	12.8	14.8	13.3	14.4	16.6	17.6	16.7	119.4

Australorp pullets show a greater average production than the White Leghorns, owing mainly to better winter production. Once again there appears to be no falling off in egg production during spring among the Australorps owing to broodiness, which becomes evident later in the year, when the warm, summer weather starts.

White Leghorns in North and South Islands

In the 1953 report a comparison was made between the egg production of White Leghorns in the North and South Islands and a similar comparison for 1954 is given in Table 2. In the South Island in 1954 there was a drop of 7 eggs per bird compared with the results for 1953, but there was a marked improvement in the production in the North Island for 1954. As in 1953 only a small number (125) of Australorps were recorded in the South Island and consequently a comparison of production of birds in the two islands is pointless.

Breeders Accredited for Egg Production

Of the 27 pullet flocks recorded during 1954 there were 16 flocks of White Leghorns. As shown in Table 1 the Dominion average over the 8 months was 120.0 eggs. Of the 16 flocks of White Leghorns recorded 10 flocks gave a flock-housed average equal to or greater than the Dominion average, and 6 flocks were below this figure. There were 11 flocks of Australorps recorded and of these, 4 flocks equalled or exceeded the Dominion average of 134.1 eggs, the remaining 7 flocks recording under this figure. The figures for the past 2 years may be summarised as follows:—

	Flocks recorded	Flocks accredited
White Leghorns		
1954	16	10
1953	22	11
Australorps		
1954	11	4
1953	9	6

A list of the names of breeders who were accredited for egg production in 1954 may be obtained from Poultry Instructors or on application to the Superintendent, Poultry Industry, Department of Agriculture, P.O. Box 2298, Wellington. These names will appear also in the annual list of accredited breeders for 1955, which should be available in August.

Mortality and Culling

Figures of deaths and birds culled are also recorded under this section of the plan and so afford information on the trend of wastage in pullet flocks. As it is difficult to differentiate between a cull bird and one that dies before it is culled, the figures for each are combined and referred to as wastage.

Of the 2278 White Leghorn pullets which were in the recorded flocks at the start 100 died and 191 were culled, giving a total wastage of 12.7 per cent. Of the 1512 Australorp pullets at the start 71 died and 64 were culled, a total wastage of 8.9 per cent. Compared with the figures for 1953 there is an improvement for both breeds, as will be seen from the following figures:—

White Leghorns Total wastage		Australorps Total wastage
1954 .. 12.7	1954 ..	8.9
1953 .. 17.6	1953 ..	15.1

This is an encouraging improvement which it is hoped will be maintained in 1955.

Electric Fence in Winter Feeding of Sheep

DURING the past 3 years a number of farmers in Southland have successfully used a two-wire electric fence when break feeding their turnip and swede crops. Using the electric fence has been found to save considerable time and labour and has made what is termed by many farmers an irksome job on the farm one that is now a pleasure. Sheep in the main do not appear to worry the fence except for the odd half dozen which manage to break through the best of fences, and for all the damage they do this is compensated for by the time and labour saved. Experience has proved that the bottom wire should be not more than 9in. from the ground with the top wire approximately 21in. from ground level.

Insulated standards are placed about a chain apart. If sufficient standards are purchased to place in position for the next break, the work of shifting is simplified. This means that only two wires have to be moved across the crop, and the first line of standards removed to the third position.

Points in favour of electric fence break feeding are that one man can comfortably do the job, whereas in the past break fencing occupied two men; it has been found that it takes only about half as long to erect this type of break fence; and the ease of shifting to a new site.

The only point against the use of the electric fence is the small number of sheep which persist in breaking through. Farmers who have adopted the method are unanimous in saying that the damage by stock in chipping bulbs ahead of the main flock is not of any account.

—C. D. DENIZE, Instructor in Agriculture,
Department of Agriculture, Invercargill

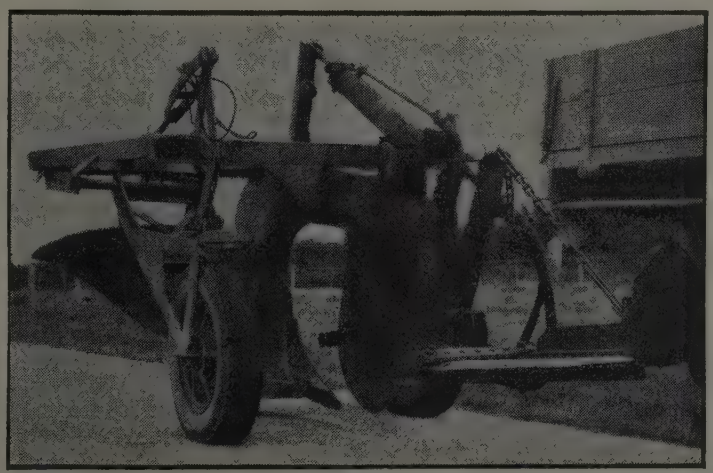
Swamp-land Improvement with Hydraulically Controlled Plough

By A. R. DINGWALL, Assistant Fields Superintendent, Department of Agriculture, Christchurch

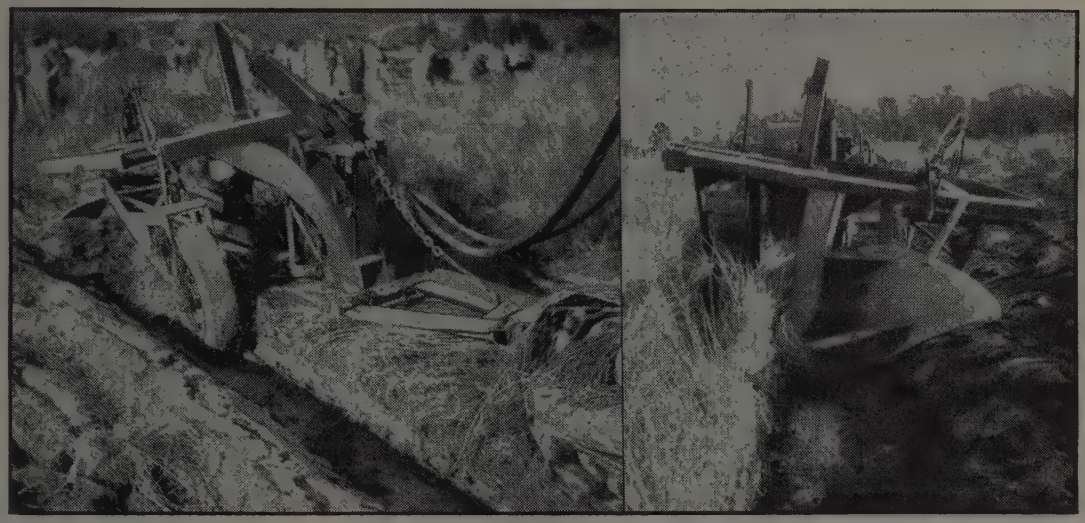
WITH the decline of gold dredging, coal mining, and timber milling in the Westland and Buller areas attention has recently become focused on methods of developing the undoubted farming potentialities of both regions. Throughout the entire length of this long, though comparatively narrow, coastal belt, with its high rainfall and temperate climate, there are numerous, and in parts extensive, areas of swamp and semi-swamp country. In the more low-lying, heavy swamps little in the way of improved farming can be achieved without installation of comprehensive and fairly costly drainage schemes, but there are many areas of less swampy land which were formerly bush clad but are now in rough grazing and reverting to rushes, blackberry, and gorse where carrying capacity could be considerably improved merely by deep ploughing and subsequent fallowing and cultivation as the initial steps in development.

IN many such places soils are deep and potentially fertile; the invading cover is not yet heavy, and the need for extensive drainage in the initial stages of development is not

Above—An area ploughed with the special type of massive swamp plough shown below. This plough is eminently suitable and has been operating successfully on the class of country described for the past few seasons.



Some logging up is usually necessary before ploughing can proceed. Where the country is still heavily timbered this initial clearing and the heaping up or windrowing and burning of surface timber over the whole area are best done before ploughing begins. Upper left—Rush and blackberry infested country capable of improvement by swamp ploughing. Upper right — Explosives are sometimes necessary to loosen difficult stumps. Middle left—Burning off timber. Lower left—Logging up before ploughing. Lower right—Crushing and ploughing under gorse (with bulldozer blade attached to the tractor).



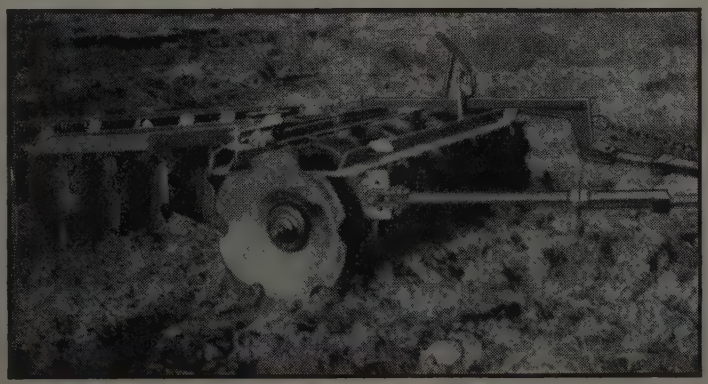
The plough at work turning a 24in. furrow 12in. deep. Left—Front view. Right—Rear view.

important as a limiting factor. Often all that is needed is removal of the few remaining logs and stumps, deep ploughing to allow the soil to dry out and mellow in the furrow, and subsequent levelling off of major surface irregularities in later cultivations. Occasionally a few chains of open main drains may be necessary to assist in the drying out process. The installation of tile drains, though not essential in the early years of development, would eventually be required for full improvement of these areas.

Heavy Equipment Required

The nature of the ground surface and of existing cover on these areas demands the use of sturdily constructed, heavy equipment with a tracklaying tractor in the initial stages of development. Some logging up is usually necessary before ploughing can proceed. Where the country is still heavily timbered this initial clearing and the heaping up or windrowing and burning of surface timber over the whole area are best done before ploughing begins. If there are only scattered logs and stumps, a portion of the area can be logged up and the relatively small heaps of accumulated debris shifted by bulldozing from the unploughed to the ploughed area as ploughing proceeds. This method while allowing ploughing to proceed also gives the heaps time to dry out sufficiently for burning.

Occasionally explosives are required to loosen some of the larger, deep-rooted stumps, but in the main the timber and any patches of scrub or blackberry can be readily dealt with by a bulldozer blade attached to the tracklaying tractor used for the ploughing.



Heavy tandem discs suitable for subsequent cultivation.

Heavy Swamp Plough

Even after this initial clearing the ploughing of the area calls for the use of a massive, sturdily built, high clearance swamp plough. The plough illustrated is eminently suitable and has been operating successfully on the class of country under discussion in the Buller districts for the past few seasons. With an over-all height exceeding 6ft. and a beam clearance of approximately 3ft. 6in. the plough is mounted on rubber. It is hydraulically controlled, from the driver's seat, through flexible, oil-resistant hose lines coupled to the hydraulic system of the 40 to 45 h.p. tracklaying tractor used to draw the plough. The rolling disc coulter is 3ft. in diameter and the massive share and mouldboard are capable of turning a range of furrow depths and widths from as shallow as 4in. to as deep as 12in. and up to 3ft. 3in. wide. The over-all weight of this special-purpose plough is 2 tons. Its ploughing rate under normal circumstances is from 2 to 2½ acres per day, though under favourable conditions 4 acres per day have been recorded.

This specially constructed plough is more a contractor's implement than one for use by an individual farmer, though where there are several hundred acres of swamp or semi-swamp country in any district or on any one property one of its type should prove a paying proposition under either individual or co-operative ownership. The plough illustrated, which is the only one of its kind in the Buller area, is in keen demand both for the development of farm lands and for constructional work by local authorities and Government Departments.

Gumboot Weather Calls for

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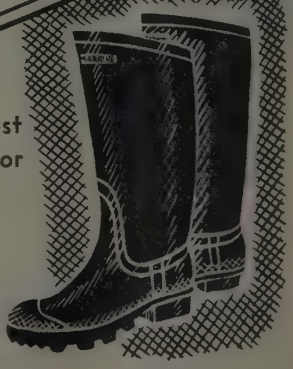

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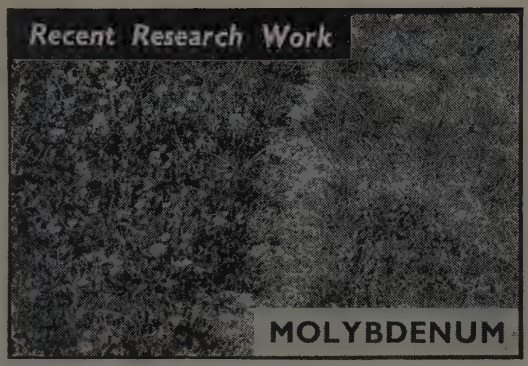

THE discovery of molybdenum-responsive soils has required the laying down of a large programme of experimental plots throughout the Dominion. Already some 600 observational top-dressing trials and 20 pasture measurement trials have been laid down. Much work remains to be done in the more exact definition of molybdenum-responsive soils and in the interactions between soil acidity, liming history, and the availability of other plant nutrients in various soils, but a number of soils have been identified where marked responses to molybdenum are likely, and these notes describe the results obtained from trials in Otago.

SOILS OF TAIERI COUNTY

SINCE the first successful molybdenum trial was laid down on the foothills above Outram in April 1950 a number of observational and mowing trials have been carried out in co-operation with local farmers. From these trials and the results obtained from farm scale applications of molybdenum the following conclusions can be drawn:—

1. Molybdenum deficiency occurs on soils of the Warepa, Wehenga, and Taioma classes. Most of the foothills soils of Berwick, Maungatua, Woodside, Outram, and North Taieri areas, portions of the coastal hills from North Taieri to Taieri Mouth, and the St. Clair-Black Head area fall into the Warepa class. Of the more elevated country, much of which is ploughable, from Harveys Flat to Deep Stream and Hindon most of the clean tussock country falls into the Wehenga class, and that which is invaded by manuka scrub is mainly of the Taioma class.

2. The most outstanding results have been obtained on the Warepa soils and though good responses have been observed on the Wehenga and Taioma soils, these have been more closely related to previous liming practice.

3. On Warepa soils good results can be expected from the use of molybdenum even where liming has been fairly heavy. Responses have occurred at pH levels from 4.8 (an area on which no lime had been applied) to 6.8 (an area which had been moderately limed and on which 2 tons of lime had been spread in the 4 years before the trial was laid down). There was no response on one area with a pH of 7.2 where 10cwt. of lime had been applied annually for many years, and unless such consistently heavy liming has been practised responses to molybdenum are likely. On areas where little or no lime had previously been applied molybdenum plus lime was superior to lime alone, and it is apparent that moderate liming to a pH of 6.0 to 6.5 is necessary to obtain the best results. The Wehenga soils are very acid and deficient in calcium, and though responses have occurred on swedes where no lime had been applied, only very slight responses to molybdenum have been observed and measured on pasture growth without the use of lime. It appears, however, that 30cwt. of lime per acre with the use of molybdenum may make possible the development of good pastures where previously 3 tons of lime was considered necessary. Areas which have been heavily limed have not shown any response to molybdenum. Results on Taioma soils indicate that they are intermediate between Warepa and Wehenga soils but more allied to the latter.

APPLICATION OF RESULTS

Where phosphatic fertilisers have not been applied responses to molybdenum have been very poor, and it is apparent that to gain the maximum benefit from molybdenum and lime applications superphosphate must also be applied at regular intervals. It is also clear that where on the Warepa soils superphosphate has given disappointing results in the past, excellent results can now be expected if an initial dressing of molybdenum is applied. The 2½oz. per acre of sodium molybdate used in most of the trials and in field applications has proved adequate. Repeat applications have shown no increased response after 2½ years and it seems likely that an initial application will be effective for upward of 5 years. In some field applications 1oz. per acre has given excellent results, and in a replicated mowing trial at Outram ⅛oz. per acre gave yields equal to the 2½oz. rate during the first 18 months. Two years after application, however, yields from the ⅛oz. treatment were on the decline. Good results have been observed on ryecorn for greenfeed, turnip, swede, and chou moellier crops, and on young sown pastures; therefore, to obtain maximum returns from land improvement and ensure the holding of good sown pastures on deficient soils molybdenum should be applied as early as possible in the development programme. Results from surface and aerial sowings of clover seeds with molybdenum and superphosphate on unploughable land of the Warepa class have been excellent. Late winter and early spring sowings have been most successful and where moderate dressings of lime have been possible the results have been more striking. On Wehenga and Taioma soils surface sowings without the use of lime cannot be expected to give good results, and it is likely that on these soils where clovers are not already present the lack of nodule forming bacteria is also a limiting factor.

—S. M. J. STOCKDILL

* * *

SOUTH OTAGO

OVER the past 3 years 16 experiments have been laid down on pasture in South Otago and marked responses have been obtained on a number of soil types of the district including the Warepa silt loams, Clydevale silt loams, Te Houka silt loams, Kaiwera silt loams, and Owaka bush soils. The area involved is more than 400,000 acres. In most of the experiments a heavy dressing of 3 tons of carbonate of lime was applied with molybdenum at 2½oz. per acre and without molybdenum. Plots with lime alone and molybdenum alone were also included. The whole trial received a basal dressing of 2cwt. of 30 per cent. potash salts and 3cwt. of superphosphate per acre. The best results were obtained on the Warepa silt loams, but more than payable results have been obtained on the other soil types quoted. Districts in which major responses have been noted are those of Warepa, Clifton, Waiwera South, Lawrence, and Clarendon. Marked responses on individual farms have been obtained at Wharetoa, Awamangu, Hillend, Clinton, and Kuriwao. The most outstanding result has been noted on the Warepa silt loam, where molybdenum alone has given a good result, but molybdenum plus lime has given excellent results. Green weights of herbage per acre were obtained as follows: Control, 2530lb.; molybdenum, 7870lb.; carbonate of lime, 9560lb.; carbonate of lime plus molybdenum, 11,140lb. Besides this marked increase in weight the clover content of the treated plots increased more than tenfold. It would appear on the soil types mentioned that where in the past a minimum dressing of 2 tons of carbonate of lime has been required for reasonable pasture growth, maximum results are obtainable from the application of molybdenum with moderate lime dressings.

—J. G. RICHARDS

HEADING PHOTOGRAPH: Left—Area treated with molybdenum, superphosphate, and lime at 2½oz., 3cwt., and 2 tons per acre respectively. Right—Control area.

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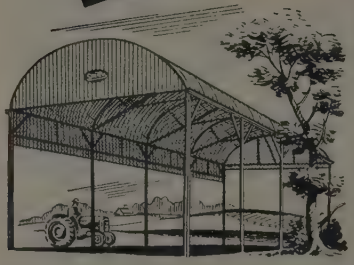

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Problems in Interpreting Soil Analyses

By C. DURING, Research Officer, Department of Agriculture, Wellington

THE growing popularity of soil testing in certain districts indicates that topdressing is becoming more complex as farming becomes more intensive. Unless a fairly complete history of an individual field is available, it is becoming increasingly difficult to assess fertiliser requirements without soil tests. Twenty or 30 years ago a knowledge of trial results on any given soil type could be applied on almost any field on that soil type with little or no modification. Today many years of topdressing, liming, haying, cropping, and other influences have changed the nutrient fertility of the individual fields so that the uniformity of manurial requirements that once existed has largely disappeared.

GOOD records of past management and topdressing are rare; in fact it is uncommon to obtain reliable information on field history for more than 3 years back. For these reasons the advisory officer in the field is confronted with a greater variety of fertility problems than ever before and any means are welcome which assist in solving such problems. The quick soil test is one of these means, but it is not the only one and perhaps not the most important one, at least not if the advisory officer is experienced. The current quick soil test, however, estimates available phosphate, calcium, and potash and measures the soil's pH reaction. It thus may give a guide to the levels of these major plant nutrients present in the soil.

This article deals with some of the aspects of the use of quick soil tests in manurial advisory work.

Depth of Sampling

The depth of sampling is very important. On permanent pasture phosphate and potash applied to the surface seem to accumulate mainly in the top 2in. of the soil and even heavy applications of limestone take 18 months to 3 years before they affect the 3in. to 6in. layer. For this reason in pasture, other things being equal, a sample of the top 4in. of soil would show almost always lower nutrient levels than a 2in. sample. The Department of Agriculture has accepted as standard the 0in. to 3in. depth on pasture and the 0in. to 6in. depth on ploughed land or land intended to be ploughed. Any deviation from these depths would seriously change the soil test results and therefore upset interpretations. To facilitate adherence to a fixed depth all officers taking soil samples are issued with special soil sampling tools on which the depth of sampling can be easily adjusted.

Representative Soil Sample

All fields are variable. Such variations are made up of random patches of often widely differing nutrient status and of gradual changes or "gradients" in fertility. The former is difficult to overcome, but the latter's influence on the soil sample composition may be lessened by careful coverage when the field is being sampled. The greater the variability in a field is the larger is the number of subsamples or cores that should be taken for reasonable certainty of a representative sample. To take more than 15 to 20 cores per sample, however, is seldom practicable, and to take less than 15 cores is inviting trouble. Careful sampling studies show that soil tests may vary considerably for a number of different samples from the one field, each sample comprising 15 cores. This variability is greatest with potash. However, it has been possible to assess the degree of variability of such soil tests and so to find the degree of difference that must be reached before any two test figures may be said to differ significantly.

Because of the complex problems of soil fertility a simple quick test cannot generally be expected to give a reliable answer by itself. The quality of interpretation depends a great deal on the experience and common sense of the man who does it.

Chemical Methods of Analysis

The possession of a representative soil sample, though very important, is only the first step. This sample has to be tested for available phosphorus, potassium, calcium, and pH soil reaction. With modern equipment the test for soil reaction is fairly straightforward, but standardised methods must be accepted for any advisory service.

For the determination of available phosphorus, potassium, and calcium there are literally scores of chemical methods. Many of these were tried and found quite unsuitable for New Zealand conditions. Those finally selected by E. B. Davies (1), of the Department of Agriculture's Rukuhia Soil Research Station, gave the best agreement with results from plot and field trials. The search for even better analytical methods is continuing and possibly in future different chemical extractants will be used for different soil types.

Interpretation of Analysis Results

It may be commonly believed that soil analyses are interpreted with the aid of simple arithmetic, that is, a certain quick test phosphate level means a high phosphate status, implying an automatic recommendation that there is "no need for superphosphate this year"; and another level means a medium status, with a consequent recommendation of "small maintenance dressings of superphosphate", and so on. This is not so. Admittedly high levels and perhaps low and medium values for pH, phosphorus, potassium, and calcium are set, but their size

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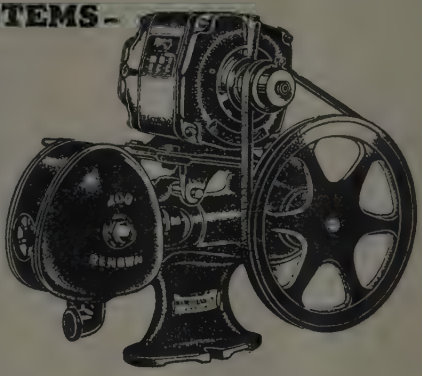

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varies according to soil type and a lot of other factors such as management, topdressing history, and the composition of the pasture and type of crop. However, the most important factor in the interpretation of quick test results is soil type.

Soil Tests

The knowledge of how variations due to soil type affect the meaning of the chemical values is not obtained without a large amount of field trial and other investigational work.

In fact soil analyses can be used with confidence only if they prove capable of extending the knowledge obtained from field trials. This applies not only to the soil tests carried out by the Department of Agriculture but also to those carried out by outside firms. No soil test is reliable by itself; it becomes so only if it has been tested thoroughly by many field trials on a soil type basis.

This becomes more clear by discussion of the individual tests.

pH Test

The pH of soil is a measure of its acidity or alkalinity.

pH 5 or lower is found in very acid soils.

pH 6 indicates moderately acid soil, often the consequence of liming acid or very acid soils.

pH 7 is a neutral reaction found mainly in soils which are high in lime or have been limed very heavily in the past.

Values above pH 7 show the soil to be alkaline. Such soils are not widely distributed in New Zealand, though fields on originally acid soils are occasionally found which have been made alkaline by very heavy and probably ill-advised liming.

In soil advisory work "threshold" pH values need to be considered. These are the lowest values at which no further pasture or lucerne or other crop responses are expected to result from additional dressing of limestone. The threshold pH value for pasture is somewhat lower than that for lucerne. This value is arrived at mainly from field trials, but must be considered to be only approximate. Nobody can claim that even on a uniform soil type responses to lime become negligible at the same pH under all conditions.

For this reason and also because in many cases there are not enough trials from which to draw evidence, tentative threshold values are set. The tentative threshold pH values of New Zealand soils may vary from 5.2 to 7 according to soil type. This wide variation is due to variations in the secondary effects on different soils which are brought about by changes in soil reaction. The greater availability of molybdenum as the soil reaction approaches neutrality is an example.

In practice it is important to have a fairly accurate threshold pH value, because 1 ton of lime may reduce acidity by only pH 0.3 to 0.5. A mistake in setting the threshold value this much too high may cost the farmer 1 ton of lime in initial dressing and higher additional maintenance dressings, for the higher the initial lime application is the higher are the subsequent losses in lime from the topsoil that need to be made up.

The threshold pH value is, however, not a soil reaction which it is always necessary to reach by liming, but one which if reached indicates that liming is not needed for some time. On certain South Island soils, for instance, quick results from liming are achieved only if relatively heavy dressings are applied, usually from 1 ton per acre upward. It may take 2 years for moderate dressings of lime to take full effect. Hence in the making of recommendations, if quick results are aimed at, it is often necessary to advise rates of liming heavier than those required to raise the soil reaction of the field to the desired level. In other soils, particularly if lime has not been applied for a long time, quite small quantities, from 2cwt. per acre upward, may give worthwhile pasture responses, though the soil reaction is hardly affected.

The interpretation of pH at all accurately and to the financial benefit of the farmer is therefore somewhat involved. It cannot be done by somebody ignorant of soil type, trial results, and other local factors.

Test for Phosphate Values

With phosphate topdressing many soils when newly broken in, or when topdressed for the first time after long neglect, need a fairly large initial build up, usually achieved in the North Island by applying superphosphate or its equivalents at 8cwt. to 10cwt. per acre in several dressings over a comparatively short period. This is known from experience and from trial results. Hence when such soils at the virgin or near virgin state are being dealt with past field evidence usually suffices and soil tests are seldom necessary unless such field evidence is lacking.

The second stage is reached when the pasture on the field has improved to a point where only maintenance dressings are needed. At this point the phosphate quick test figure would usually still be low, and it is unlikely that from it alone it would be possible to tell whether the heavier or more frequent initial dressings could be replaced by lighter or more infrequent maintenance dressings.

After some years of regular phosphatic topdressing, however, pasture responses to phosphate tend to decrease. In other words the residue of past applications plus stock droppings supply all or nearly all the phosphate needed by pasture species. This was well illustrated by a pasture measurement trial at Marton Experimental Area and by general observations during the war, when phosphatic fertilisers were rationed. The stage at which the residual effect of past applications can be used to reduce maintenance dressings is probably influenced by the relative supply and spread of stock droppings to different fields on the farm.

The figure, if determinable, in the phosphate quick test at which it is just safe enough to recommend a reduction in phosphate topdressing from the customary maintenance rate to something far less is called the threshold value.

Before a threshold value for the phosphate test can be arrived at very definite trial evidence is needed that its use is justified. Hence at present several pasture measurement trials are being conducted on high phosphate testing soils in the Hamilton and Matamata districts and a similar series of observational and mowing trials exists in the New Plymouth district. In these trials pasture responses to several rates of phosphate are measured and observed. Evidence is also being accumulated in other districts. In a few years it should be possible to have an idea of the level of phosphate test at which pasture responses become negligible.

It is known already that a certain level of the phosphate test does not mean the same thing on all soils. For instance, at a phosphate level of 10 as expressed in the current quick test no response or only very slight responses are expected on Hamilton clay loam, though on Kaipara clay or Horotiu sandy loam responses would be very likely.

Thus on Hamilton clay loam a phosphate value of 10 would be a fairly close estimate of the level at which phosphate topdressing could be reduced or omitted for a year or two. However, less complete evidence exists for other soils and hence the threshold value must be kept high to be safe.

Phosphate tests can, of course, be interpreted without an accurate definition of threshold value merely by placing more emphasis on phosphate topdressing when the test is relatively low and less emphasis on phosphate topdressing as the phosphate figure increases.

Test for Potash Values

The potash test has been of great value on certain soils in the Waikato, Northland, Bay of Plenty, Taranaki, and a few other districts in showing how widespread and serious potash deficiency really is. In interpretations it is again necessary to set a threshold value marking the boundary between high and low supply of available potassium, or in other words between quick test levels indicating a probable response and those indicating that a response is unlikely.

There is, however, one serious drawback to potash quick tests. The test figures do not, in general, rise very much after heavy applications of potash have been made to a field. On certain soils the same may be said

with the phosphate test after applications of heavy rates of superphosphate. However, it is known that phosphate is fixed rather readily on these soils and that for this reason the phosphate test tends to indicate the true position with regard to availability of phosphate. But it is not certain that this happens with the potash test and it is assumed, for the present at least, that the potash quick test cannot be relied on to indicate when a farmer has put on enough potash. In practice, of course, potash is seldom applied in quantities which would stimulate high pasture production for more than a year and hence a potash test would seldom be required once a field is proved to be potash deficient. It is necessary merely to refer to the results from rate of potash trials and to the general appearance of the field in advising on maintenance dressings.

The threshold value of the potash quick test varies with soil type. It tends to be higher on those soils which suffer most severely from potash deficiency and it is known to be lower and sometimes not determinable by the present quick test on certain soils in which there is a large store of potash combined in particular clay minerals but on which plants can draw during the season.

Test for Calcium Values

The quick test for available calcium has not yet been correlated to any extent with pasture responses to lime, because it is felt that the pH is the most important information with regard to lime requirements on most soils and once the pH is raised to a satisfactory level the calcium figure automatically follows.

The calcium figure promises, however, to be of value on some soils. Thus high pH values are sometimes found in the presence of very low exchangeable calcium on soils derived from volcanic ash or from windblown sand. In such cases low rates of lime may be recommended. On the other hand when very high calcium figures are combined with pH 5 to 5.4 (rather acid conditions) on certain heavy clays field trials are necessary to find what the calcium figures mean in terms of lime requirements.

Quick Test Levels and Lime and Fertiliser Applications

The interpretation of the soil quick test relies mainly on the results of field trials and other concrete evidence and the quick tests are used only to extend this knowledge. If the soil test figures are near the known threshold value, it is reasonable to assume that pasture and crop responses to the fertilisers or lime are becoming smaller and may even be absent. In those cases, therefore, it may be necessary to apply only a minimum maintenance dressing, its size depending mainly on general knowledge of the district and other factors such as trial results, management, the purpose to which the pasture is put, and the type of crop.

The pH test lends itself better than the phosphate and potash test to quantitative interpretation, because the lime needed to raise the pH can be calculated reliably from liming trial records and other field data.

Main Points to be Considered

A summary of the main points is as follows:—

To obtain a representative soil sample for quick test analysis at least 15 soil cores should be taken in a field, obvious irregularities being avoided.

The soil test **by itself** without reference to soil type, pasture quality, type of crop, and management cannot be used for interpretation, except where individual levels of nutrients tested are extraordinarily high or extremely low.

Advice on liming and topdressing is given by the Department of Agriculture on the basis of results from a large number of topdressing trials with major and minor elements from which the soil type and chemical soil test are known.

For this reason pH, or in other words the measure of soil reaction, is a reliable guide for advising on lime and molybdenum applications on most major soil types in New Zealand.

Knowledge on the interpretation of the phosphate test is steadily increasing. At present instructors confronted with a phosphate test of a certain magnitude can suggest, if not always advise, a reduction in maintenance dressings.

The potash test, by showing a widespread but hitherto almost unknown potash deficiency in the Waikato, has done more than anything else to boost the popularity of the soil testing service. The successful application of the test is, however, at present limited to certain responsive soil types and fields which have not been heavily topdressed with potash in the past.

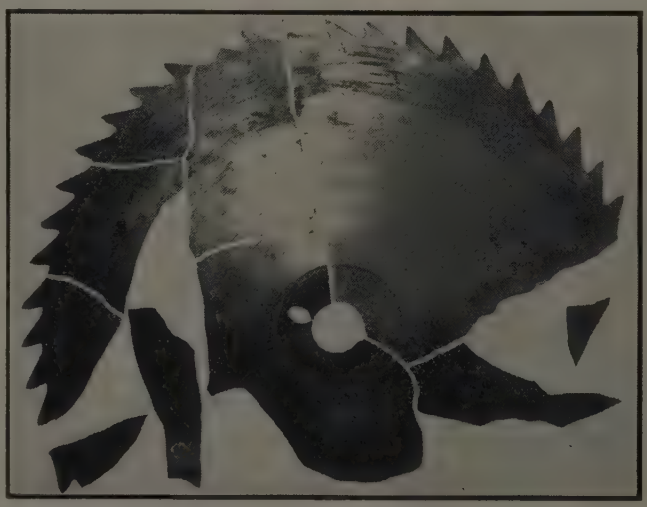
In general owing to the complex problems of soil fertility no simple quick test can be expected to give a reliable answer by itself.

The quality of interpretation depends a great deal on the experience and common sense of the man who does it.

Reference

1. E. B. Davies, "New Zealand Journal of Agriculture", Vol. 87, No. 4, p. 306, 1953.

Danger of Faulty Use of Farm Circular Saw



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—C. M. B. OLIVECRONA, Machinery Instructor, Department of Agriculture, Wellington

Seasonal Fluctuation and Incidence of Ring Spot on Granny Smith Apples

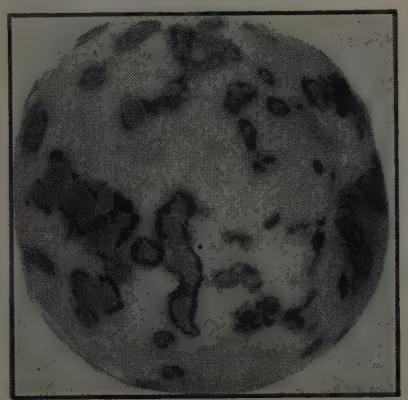
By C. E. WOODHEAD, Pip Fruit Specialist, Department of Agriculture, Palmerston North

THE history, symptoms, and probable nature of apple ring spot, better known under its earlier name of Henderson spot, have been described by Atkinson, Fruit Research Station, and Chamberlain and Hunter, Plant Diseases Division, Department of Scientific and Industrial Research, in an article published in the "New Zealand Journal of Science and Technology" in April 1954. The authors record that this disease of the Granny Smith apple was first observed about 1935 at Brightwater, Nelson, and 4 years later near Auckland, only a few trees being affected in either locality.

THE following description of symptoms is taken from the article:—

"Symptoms of ring spot have been found only on apple fruits. Trunks, branches, and leaves of affected trees appear normal and growth is not visibly affected. First signs of the disease appear in early December when young apples are about 3 cm. in diameter. At this stage faint, light brown areas show through the downy covering of small fruit. These markings develop into irregular shaped patches of varying shades of brown with a rough, russeted surface and a scaly margin. In this form ring spot symptoms closely resemble bronze beetle injury and some types of spray russet. Shortly before harvest a narrow band of smooth, dark brown tissue forms round the margin of many spots, and this is regarded as a reliable diagnostic feature [Fig. 1]. After picking this outer brown strip occasionally continues to develop, but most spots remain unchanged throughout the storage life of affected apples."

Less common symptoms, which took the form of concentric rings of dark brown tissue mixed with patches of rough, scaly russet, were also described. The rings were usually fragmentary (Fig. 2). A few apples were also found with sets of concentric rings but no russet patches. In all instances blemish was superficial and flavour and storage quality were not affected.



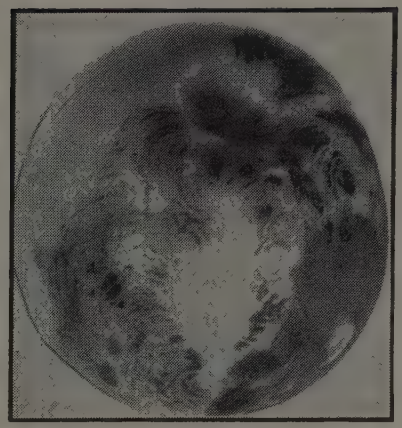
[*Department of Scientific and Industrial Research*
Fig. 1—Granny Smith apple showing typical ring spot symptoms with dark brown margins well developed on many spots.

In the same article it was also reported that: "Grafting experiments have shown that symptoms are perpetuated in infected scions and suggest that the disease is transmitted slowly from infected scions to healthy trees. It is thought that the disease may be caused by a virus."

In 1949 ring spot caused some concern to growers of Granny Smith in Auckland and in that year investigations were begun, the Department of Scientific and Industrial Research investigating the nature of the disease and the Horticulture Division concentrating on observations in orchards. This article deals with the last-mentioned phase of the investigation and gives the results of orchard observations made by Horticultural Instructors from 1949 to 1953. Observations were at first limited to study of the behaviour of ring spot in selected Auckland orchards, but were later extended to include the general incidence of the disease in Auckland, Hastings, and Nelson.

Observations in Two Auckland Orchards

Detailed observation of ring spot in the orchard was necessary so that an answer to the following question could be provided: How quickly does ring spot spread, first, in the orchard and secondly, in the crop of individual trees?



[*Department of Scientific and Industrial Research*
Fig. 2—Fragmentary concentric rings and extensive russet areas on Granny Smith apple infected with ring spot.

In 1949, therefore, two blocks of Granny Smith trees were selected for observation. One block formed part of a Henderson orchard and contained 150 trees, of which approximately a third were infected, some severely. The second block, at Oratia, consisted of 43 trees, of which 20 were infected, though less severely than those in the Henderson orchard.

Observations on ring spot infection were made each season in early December and again in late March or early April, all trees in each block being examined for fruit symptoms. Trees were graded in four categories according to the number of infected fruits.

Table 1 gives the over-all picture of infection in the two orchards for the period of observations. Three additional trees became infected in Orchard A in the 3 years after 1949, representing an annual spread of infection of only 0.66 per cent. of all trees in this block. New infections in Orchard B totalled seven over 4 years, an annual spread of 4 per cent. All new infections in Orchard A occurred in one year (1950), and six of the seven new infections in Orchard B were also recorded in that year.

Table 1 also shows, however, that despite fresh infection there was a sharp fall in 1950 in both orchards in the total of trees showing ring spot symptoms, with little change in later years except for a temporary drop in Orchard B in 1951. It is also clear that though the number of trees included in the various categories of infection has varied from year to year, in 1952 there were fewer severely infected trees in Orchard A than in 1949. In Orchard B infection was slight in all trees during the last 4 years of observations.

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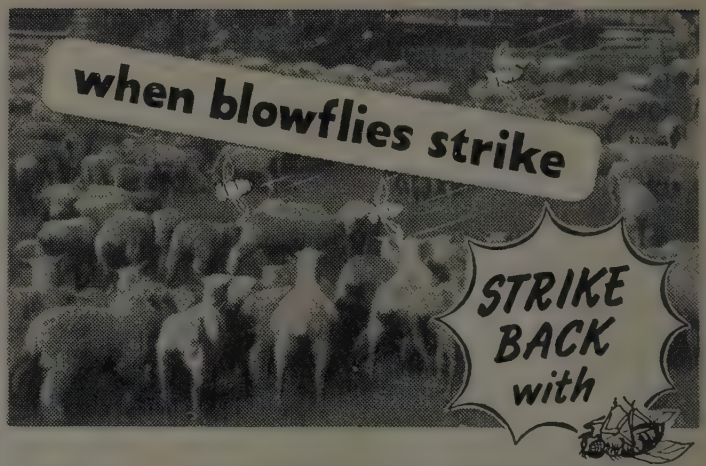

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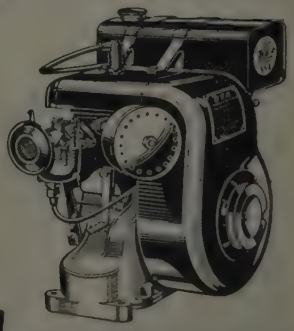

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N.Z. Distributors: MESSRS. AGRICULTURAL CULTIVATORS (N.Z.) LTD., P.O. Box 1102, Auckland.

TABLE 1—APPLE RING SPOT INFECTION OF GRANNY SMITH TREES IN TWO AUCKLAND ORCHARDS FROM 1949 TO 1953

	No. of trees in orchard	Trees with no symptoms	Trees infected since 1949	No. of infected trees and degree of infection				Percentage of total trees
				Slight*	Moderate*	Severe*	Total	
Orchard A (Henderson)								
1949	150	99	—	21	17	13	51	34.0
1950	150	127	3	12	7	4	23	15.3
1951	150	127	—	9	12	2	23	15.3
1952	150	125	—	14	3	8	25	16.6
1953†	150	—	—	—	—	—	—	—
Orchard B (Oratia)								
1949	43	23	—	6	14	—	20	46.5
1950	43	30	6	13	—	—	13	30.2
1951	43	39	—	4	—	—	4	9.3
1952	43	30	1	13	—	—	13	30.2
1953	43	30	—	13	—	—	13	30.2

* Slight = 1 or 2 infected fruits. Moderate = several infected fruits. Severe = numerous infected fruits.
† Not recorded owing to heavy infection of black spot.

Spread and Seasonal Fluctuation on Individual Trees

Table 2 shows for Orchard A the seasonal fluctuation of ring spot infection in the crop of individual trees severely infected in 1949. In 9 of the 13 trees ring spot symptoms appeared each year, though the degree of crop infection varied from season to season. In the remaining 4 trees ring spot was not in evidence in some years, but in only one instance, that of No. 3 tree, were symptoms absent for more than one season. It is therefore evident that symptoms are persistent in trees severely affected.

Of the 17 trees recorded in Orchard A as being moderately infected in 1949 (Table 1), 4 showed no symptoms in subsequent years. The progress of ring spot in the remainder is shown in Table 3. In these trees seasonal non-appearance of symptoms occurred more frequently than in the severely infected trees. It is also significant that in no tree did crop infection progress from the moderately infected to the severely infected stage.

TABLE 2—SEASONAL FLUCTUATION OF APPLE RING SPOT INFECTION IN TREES SEVERELY INFECTED IN 1949 IN ORCHARD A (HENDERSON)

Tree no.	1949	1950	1951	1952
1	XXX	XXX	XX	XXX
2	XXX	X	0	X
3	XXX	XX	0	0
4	XXX	XXX	X	XXX
5	XXX	0	XX	0
6	XXX	0	XXX	XXX
7	XXX	XXX	XXX	XX
8	XXX	XXX	X	XXX
9	XXX	XX	XX	XXX
10	XXX	XX	XX	XXX
11	XXX	X	XX	XXX
12	XXX	X	X	X
13	XXX	XX	XX	XXX

0 = no symptoms.
X = slight infection (1 or 2 fruits).
XX = moderate infection (several fruits).
XXX = severe infection (numerous fruits).

In 1949 there were 21 slightly infected trees in Orchard A (Table 1). On 15 of these trees ring spot symptoms did not reappear in the subsequent 3 years of observation. Annual crop infection of the remaining 6 trees is as follows:—

Tree	1949	1950	1951	1952
1	X	XX	X	X
2	X	0	0	X
3	X	0	0	X
4	X	0	X	0
5	X	0	0	X
6	X	X	0	0

0 = no symptoms. X = slight infection (1 or 2 fruits). XX = moderate infection (several fruits).

Only in one tree did crop infection show an increase, from slight to moderate, and then only for one season.

In Orchard B crop infection in later years of individual trees showing symptoms in 1949 (Table 1) followed a similar general pattern in disappearance of symptoms in a number of the trees and seasonal fluctuation of symptoms in the remainder. Details of individual trees are therefore not given. An important point of difference between Orchard B and Orchard A (Table 3) was that none of the trees moderately infected in 1949 showed more than slight crop infection in later years.

Incidence in Fruit Growing Districts

During 1951 to 1953, concurrently with the study of ring spot in the two selected orchards, the distribution of the disease was investigated in Auckland, Hastings, and Nelson, the districts where Granny Smith is chiefly grown. Though a systematic survey of orchards was not made, horticultural instructors used every opportunity to examine blocks of this variety during visits to orchards. Many infected orchards were also traced after the discovery of symptoms in lines of fruit inspected at assembly depots or in rejects examined in packing sheds. The following is a summary of the number of infected orchards recorded in the districts at the conclusion of the investigation in 1953:—

Auckland: Ring spot was found in 54 orchards, representing almost 60 per cent. of the Granny Smith orchards in the district. Infected trees were located throughout the district, from Port Albert in the north to Henderson west of Auckland city. Though Hamilton was not included in the survey, ring spot symptoms were also

TABLE 3—SEASONAL FLUCTUATION OF APPLE RING SPOT INFECTION IN TREES MODERATELY INFECTED IN 1949 IN ORCHARD A (HENDERSON)

Tree no.	1949	1950	1951	1952
1	XX	0	X	0
2	XX	X	0	X
3	XX	0	X	X
4	XX	X	X	X
5	XX	0	0	X
6	XX	X	0	X
7	XX	0	XX	X
8	XX	0	XX	0
9	XX	X	XX	X
10	XX	0	XX	0
11	XX	XX	XX	XX
12	XX	X	X	X
13	XX	XX	XX	XX

0 = no symptoms.
X = slight infection (1 or 2 fruits).
XX = moderate infection (several fruits).

National Diploma in Fruit Culture

OF the diplomas which may be gained by examinations held by the Royal New Zealand Institute of Horticulture, the National Diploma of Horticulture—N.D.H.(N.Z.)—has been instituted since 1927. A more recent diploma is the National Diploma in Fruit Culture—N.D.F.C.(N.Z.). The period of training for this diploma is 6 years' practical work and there are three stages of examination, junior, intermediate, and diploma, which are normally taken at intervals of 2 years.

These two diplomas provide an opportunity for those already engaged in horticulture and for those who desire to take up a career in one of the many branches of horticulture to obtain technical qualifications based on a sound practical training.

The Royal New Zealand Institute of Horticulture Act 1953 provides that the institute may, on the recommendation of the Examining Board, without examination, grant the National Diploma in Fruit Culture to any person who is not less than 40 years of age and has practised horticulture or any branch of it for not less than 20 years and who in the opinion of the Examining Board is qualified to receive the diploma. The period during which the diploma may be awarded without examination is 2 years from September 1953. Experience as an instructor in fruit culture will be accepted as practical experience.

Fruit growers and others who are over 40 years of age and who have had the necessary practical experience are invited to apply to the Dominion secretary of the Royal New Zealand Institute of Horticulture, Box 1368, Wellington, for the award of the diploma. Applications to the Dominion secretary should be made before the end of June 1955.

recorded in 1953 in a commercial orchard in that area.

Hastings: Ring spot was found in each of 30 orchards inspected. Infection was widespread in the district.

Nelson: Of the 37 Nelson orchards in which Granny Smith is grown infection was recorded in 21. At Motueka the disease was also reported as present in each of the 56 orchards containing trees of the variety. Incidence at Mapua was investigated less fully, but symptoms were noted in several orchards.

Apple ring spot is therefore widely distributed in the districts investigated and it is reasonable to assume that a complete survey would disclose a still greater incidence of infection.

Economic Significance

In some years ring spot has caused fairly considerable loss in orchards containing a number of severely infected trees. In 1952 in one Auckland block of 125 trees 12 showed 100 per cent. crop infection and a further 60 trees were infected in varying degree. Loss in this orchard was estimated as follows:—

	Cases
Total crop	500
Fruit showing ring spot ..	100
Rejects for ring spot ..	30

This estimate does not show the additional loss incurred through degrading of a proportion of the infected fruit to "Commercial" grade.

Serious loss in the Auckland district has, however, been confined to three orchards. In others rejects have ranged from a few fruits to not more than 5 cases. In 1952 it was estimated that apples showing ring spot symptoms represented less than 1 per cent. of the Auckland Granny Smith crop and that fruit excluded from "Commercial" grade because of infection did not exceed 100 cases.

In the Nelson district loss through ring spot has been on a similar scale, most orchards having a few cases of rejects in 1953. In Hastings reject fruit has amounted to less than 1 per cent. in the most severely infected orchards and the total loss has been negligible.

Apple ring spot has not therefore assumed any great economic significance during the years of observation. The substantial loss of crop recorded on individual trees through fruit becoming unsaleable indicates, however, the need for careful bud selection, as it has been shown conclusively that ring spot is perpetuated in scions taken from infected trees.

Acknowledgment

The assistance of the many Horticultural Instructors who recorded the data presented in this article, especially that of H. A. Prew for most of the detailed observations in the two Auckland orchards, is acknowledged.

Radio Broadcasts to Farmers

RADIO broadcasts to farmers will be given during April as follows:—

1XH Hamilton

11 April (12.33 p.m.)—"Bovine Tuberculosis and the Farmer", by G. R. Mackintosh, Livestock Instructor, Department of Agriculture, Hamilton.

18 April (12.33 p.m.)—"Pasture Renovation", by J. R. Murray, Instructor in Agriculture, Department of Agriculture, Hamilton.

29 April (8.10 p.m.)—"Current Farming Problems", by a panel of speakers.

1YZ Rotorua, 7.15 p.m.

14 April—"Cover Crops for the Home Orchard", by H. A. Prew, Agricultural Instructor, Department of Agriculture, Tauranga.

28 April—"Work for the Coming Month", by G. A. Blake, Instructor in Agriculture, Department of Agriculture, Matamata.

4YA Dunedin, 9.15 p.m.

6 April—"Habits of Various Races of Honey Bees", by I. W. Forster, Apiary Instructor, Department of Agriculture, Oamaru.

13 April—"Notifiable Diseases", by D. H. Le Souef, Livestock Superintendent, Department of Agriculture, Dunedin.

20 April—"Preventable Wastage in the Meat Industry", by I. M. Cairney, Veterinarian, Department of Agriculture, Dunedin.

27 April—"Rabbit Destruction", by J. P. Shennan, Assistant to Livestock Superintendent, Department of Agriculture, Dunedin.

Regular Sessions

1XH Hamilton, Mondays at 12.33 p.m. and Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8.5 p.m., Wednesdays at 8.1 p.m. (Northland stock market report), Fridays at 8.1 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month), Thursdays at 12.33 p.m. and 7.15 p.m. (fortnightly).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawkes Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawkes Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Mondays at 8 p.m. (Pleasant Point stock market report), Tuesdays (fortnightly) at 8 p.m. (Temuka stock market report), Wednesdays at 8 p.m., and Saturdays at 10.30 a.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Thursdays at 12.33 p.m.

4YA Dunedin, Mondays at 12.33 p.m., Wednesdays at 7 p.m. (Burnside stock market report), Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 7 p.m.

Auckland Broadcasts to Farmers

Station 1YA Auckland began on 7 February a ½ hour farm session on Mondays to Fridays at 7.45 p.m. and on Saturdays at 6 p.m.

Reports will be given on the stock markets throughout the Province and on the fruit and vegetable markets in Auckland. On Friday nights there will be a review of the week's farming news and on Saturdays at 6 p.m. a review of the stock markets throughout the Province during the preceding week.

In addition the programmes will bring farmers up-to-the-minute advice on current problems, interviews with progressive farmers, reports from the research stations, reviews of books of interest to country listeners, newsletters from various parts of the country, a monthly Young Farmers' Club session, and general material of interest to farmers.

The subjects covered are:—

Mondays: Including reports from vegetable and fruit markets.

Tuesdays: Including Frankton stock market report.

Wednesdays: Talks by officers of Department of Agriculture. Westfield and Northland stock market reports.

Thursdays: Including report from vegetable and fruit markets. Every second Thursday, a programme for smaller farmer (market gardens, poultry, bees, etc.), including a contribution by officers of Department of Agriculture.

Fridays: Including the week's farming news and Morrinsville stock market report.

Saturdays: Auckland provincial stock market review.

EDITOR: P. MACKINTOSH

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Oversowing and Topdressing on Wanganui Hill Country

By A. A. DUNCAN, Instructor in Agriculture, Department of Agriculture, Wanganui

TRIALS with oversown clovers, phosphatic fertilisers, and lime have been carried out over the past 4 years on Wanganui hill country at Kauangaroa, 20 miles inland from Wanganui. This country was originally in broadleaf forest and has a rainfall of 40in. which is generally well spread, though there are occasional drought years. The hills have an average elevation of 500ft., are moderately steep to steep, and have a tendency to revert to manuka. The typical soil type of the area is 114 (Whangaehu sandy silt loam); it has a dark grey, sandy loam topsoil merging into a pale yellow, silty loam subsoil. Underlying the subsoil is sandstone. The pasture cover without topdressing is browntop-danthonia dominant with some crested dogstail, perennial ryegrass, sweet vernal, Yorkshire fog, ratstail, white clover, and annual clovers. The carrying capacity is approximately 2 sheep per acre with a proportion of cattle to keep the pastures in order. The sheep flocks are for the most part Romney breeding flocks and the cattle are bred on the country.

THE phosphates compared in the trials were North African rock, superphosphate, finely ground Nauru rock, basic slag, "Fertiphos" (a concentrated reverted phosphate), and serpentine superphosphate. These were applied at rates equivalent to 3cwt. of superphosphate per acre. There were no spectacular responses to phosphate when compared with those on the volcanic ash country of the Central Plateau of the North Island, but the responses obtained were payable. An important benefit from phosphate on this country is that it raises the fertility to a point where reversion to manuka is halted; the application of phosphate is the cheapest way of combating manuka.

Superphosphate gave the best result and this was closely followed by that from serpentine superphosphate. The other types of phosphate gave useful responses, except finely ground Nauru rock phosphate, the response to which was disappointing. The slower acting phosphates (North African, basic slag, Nauru rock) did not give relatively better responses as the trials progressed. Superphosphate gave the best initial response and continued to do so. The general effect of the application of phosphate was a marked increase in the vigour of the clover and an improvement in the growth, colour, and palatability of the grasses. Applications of 5cwt. of lime per acre

The crosses indicate the locations of the trials. The shaded portion indicates hill country with a similar rainfall and soil to those of the trial areas.

HEADING PHOTOGRAPH: Typical Wanganui hill country. This country, like most parts of the North Island, is basically deficient in phosphates, and this deficiency must be made good before any worthwhile gains can be made directly in pasture improvement and indirectly in carrying capacity.

annually for 3 years with the various phosphatic treatments did not show to any advantage. There was no pasture response to lime or at best a doubtful one. The analyses of soil samples taken from the untreated plots of the trials suggested that a response to liming might have been likely. The available calcium was fairly low and the pH values were 5.4 (fairly acid) and 5.8 (moderately acid). The trial results, however, indicate that on Whangaehu silt loam in the early stages of topdressing lime applied in small quantities is of little benefit even if this soil is fairly acid.

Clovers Used

The clovers used for oversowing were white clover, Montgomery red clover, subterranean clover, and *Lotus major*. White clover was used at 2lb. per acre, Montgomery red clover at 3lb., subterranean clover at 3lb., and *Lotus major* at ½lb. White clover proved much the best clover to oversow on this particular kind of hill country. It established quickly and subsequently spread over the ground with its surface rooting system and played a particularly valuable part in the sward. The ability of white clover to root from overground runners enables comparatively isolated plants to spread out and eventually knit together into a very useful cover. Subterranean clover gave a good strike and initial establishment, but after that did not make its presence felt to any extent. The plants persisted, but they lacked vigour, with the result that this clover produced very little feed. The 3lb. sowing of Montgomery red clover did not result in a thick cover on the red clover plot even in late summer, when it was at its maximum growth. It persisted over the 4 years under sheep grazing and made some growth, but it was small in relation to the white clover. *Lotus major* did not prove to be of any value, probably because the rainfall was not high enough to provide it with a suitable environment. *Lotus major* can be found in isolated places throughout the Wanganui hill country, but it is almost invariably around seepage points and creeks.

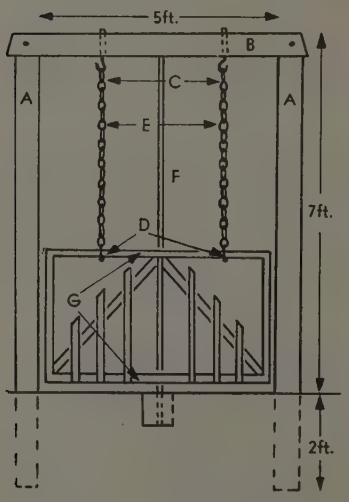
Recommended Treatment

The recommendation arising from these trials is to topdress with 2cwt. to 3cwt. of superphosphate every second year and oversow with 2lb. of Certified white clover at the initial topdressing; sowings in March/April have given good germination and establishment. The clover is necessary in the sward to make the best use of the applied phosphate.

Phosphate directly improves the grass growth to some extent, but its main effect is indirect in that it stimulates the clovers and they in turn supply more nitrogen to the grasses and enable them to grow more vigorously.

With the use of the aeroplane the annual acreage topdressed and oversown is increasing rapidly and this is enhancing the appearance of the hill country and improving the pasture. The browntop-danthonia pastures are being opened up and their place is being taken by increasing amounts of crested dogstail, perennial ryegrass, and white clover. The Wanganui hill country, like that of most parts of the North Island, is basically deficient in phosphates, and this deficiency has to be made good before any worthwhile gains can be made directly in pasture improvement and indirectly in carrying capacity.

A Self-closing Gate which is Easily Made



A—Two good posts about 6in. x 4in. and 9ft. long. B—Cross-beam of 6in. x 4in. timber. C—Two ½in. hooked bolts. D—Two ½in. eye bolts. E—Two strong chains or light cables. F—The pipe showing the lower end embedded in concrete and the upper end with a flange screwed to the pipe and screwed to the wooden beam. G—The top and bottom rails of the gate should be made of hardwood to stand up to the wear on the centre axle.

A GARDEN gate which closes automatically is shown in the accompanying illustrations.

The gate is hung from an overhead cross-beam on two chains and turns on a piece of ¾in. piping. This pipe passes through the top and bottom rails of the gate and is fixed to the overhead beam by a flange and is embedded in concrete at the bottom end. The action of the gate opening twists the chain away from the vertical position and also raises the gate a few inches on the pipe. Consequently when it is released the gate drops and swings back to the closed position.

To hold the gate open either attach both chains in one hook, as shown in the right-hand photograph, or place a block underneath it.

—*N. J. HIAM,*
Horticultural Inspector,
Department of Agriculture,
Auckland

Onion Seed Production

By W. F. LEONARD, Instructor in Agriculture, Department of Agriculture, Blenheim

THE presence of suitable soils in an area with such a favourable climate makes the lower Wairau Plain about Blenheim an ideal district for the production of onion seed. Advantage is taken of this situation to the extent that approximately 80 per cent. of the onion seed produced in the Dominion is grown in Marlborough. The land used lies within a radius of 6 miles to the north and north-east of Blenheim, the bulk of the seed crops being grown on Opawa deep silt loam soil and some on Spring Creek heavy silt loam. Opawa silt loam is a rich, deep alluvial soil which was laid down comparatively recently and which, though possessing a satisfactory moisture-holding capacity, is at the same time fairly well drained. Spring Creek heavy silt loam as its name implies is a heavier soil through which drainage is somewhat slower.

THE chief qualities to be looked for in a variety of onions for commercial growing include yielding ability, keeping quality, and resistance to disease. In past years the Brown Spanish, Straw Spanish, Ailsa Craig, and Giant Rocca varieties were commonly grown, but none of these was entirely satisfactory for the commercial grower. Brown Spanish keeps well, but is very subject to mildew attack and is not a heavy cropper. Ailsa Craig and Giant Rocca crop well, but keep poorly. Straw Spanish crops reasonably, but is of only medium keeping quality.

About 20 years ago it became apparent that some improvement in variety would be to the benefit of the onion industry. About that time the late Mr. J. Turbott, of Pukekohe, made a selection of Straw Spanish of considerably improved keeping quality, which he named Pukekohe Long Keeper. Mr. Turbott continued to maintain supplies of seed of this onion and after trials to determine its keeping quality it has been recognised under the Department of Agriculture's seed certification scheme.

For a number of years Pukekohe Long Keeper has been the predominant onion variety in New Zealand. This has had a direct effect on the onion market of New Zealand. Previously it was necessary to import onions for the later months of the storage period, as the locally grown onions would not keep until the first of the new crop became available. Now it is possible to store Pukekohe Long Keeper onions without undue loss until the next season's crop starts to come in, and imports need be considered only when general production is below requirements.

Other varieties are now grown only to meet particular needs. A newly developed variety which is creating interest at present is Rangitikei Red, a red skinned, high yielding onion. This variety under Department of Agriculture trial was below Pukekohe Long Keeper in keeping quality.

Cultural Practices

Onion seed does not fill any particular place in the crop rotation, being grown frequently after pasture, peas, or beans. Land intended for an onion seed crop is usually ploughed during late autumn so that early frosts may play their part in aiding final cultivation in readiness for the planting of bulbs in May or June. Before planting bulbs are picked over by the grower or the firm supplying them so that undesirable types, such as "doubles" and those with thick necks or starting to sprout can be discarded. Where possible an even line of medium-sized bulbs is preferred. Large bulbs plant a smaller area and those with a diameter of about 2in. are generally considered by growers as most suitable.

Planting is done by hand, but the details connected with it vary among growers. In most cases a cultivator is used to draw a mark or open a shallow furrow and the bulbs are pushed in either by hand or with the aid of a trowel. Rows are spaced to suit cultivating implements—24in. to 36in. apart—and the bulbs are planted at intervals of from 10in. to 16in. Where the inter-row space is wider bulbs are usually planted closer together in the row and vice versa.

HEADING PHOTOGRAPH: Crop of Certified Pukekohe Long Keeper onions at the early flowering stage.

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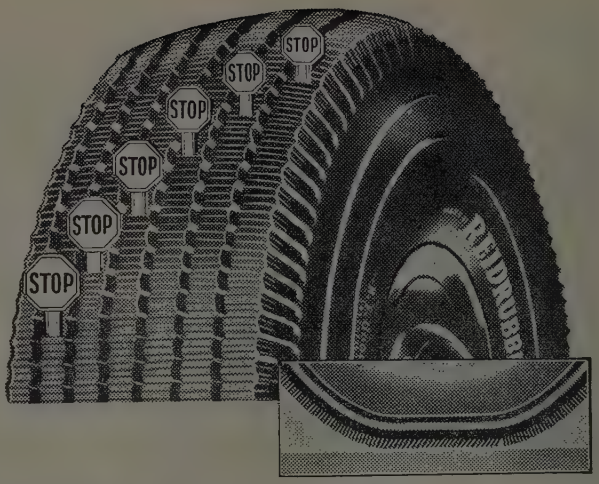

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This means that the total quantity of bulbs planted may be fairly similar in either case and the weight of average-sized bulbs required to plant an acre would be from 20cwt. to 25cwt. When planted the bulb is just covered. If bulbs are planted too shallow, the mature plant will be in danger of being blown over by wind. This danger is reduced and at the same time a measure of weed control effected by going through the crop and putting up a low mould at one or two stages after planting. However, this practice is not adopted by all growers.

Weed Control

Weed control is done by intercultivation with a small garden tractor or a multi-row cultivator fitted to a farm tractor. These implements are used until the plants reach a stage where further passage of machinery would cause damage. At the same time the rows themselves are kept clear of weeds by hand hoeing, usually at least twice.

Cultivation goes on until the seed stalks begin to spread over the space between the rows. If the crop is free of weeds at this stage, subsequent weed growth does not normally affect the yield. Where weed growth is not adequately controlled the crop not only suffers from direct competition with weeds but is more subject to attack by mildew. Tall weed growth increases humidity about the onion plants, thus providing suitable conditions for the growth of mildew.

Though sulphuric acid is commonly used for weed control in onion bulb crops, seed crops are susceptible to damage by this material and virtually no chemical means of weed control are employed by onion seed producers. Some preliminary work with a number of selective weedkillers has, however, been done and one or more of them may possibly prove useful.

Fertilisers

The soils in which onion seed crops are grown are fertile alluvial ones which in the main are regularly and fairly liberally fertilised with lime and phosphate for the growing of other crops. Consequently fertiliser is not often applied at planting, but a side dressing of blood and bone or a mixture of blood and bone and superphosphate at 2cwt. to 3cwt. per acre is commonly applied in spring.

Harvesting

Seed heads do not all mature at the one time and to avoid loss of seed through shedding, harvesting is usually carried out in two stages. This means that the crop must be cut by hand and the method is to cut through the stalks just below the seed heads and to collect the heads into sacks. Even where a crop could all be harvested at one time the risk of seed loss and the unsuitability of the crop for mechanical means of harvesting would still make hand cutting the most satisfactory method. The crop is cut when the seed in the top of the heads turns black, and in a normal season harvesting would be done from mid-February to early March.

When cut the seed heads are allowed to "sweat" for a time and are then dried out for threshing. The practice of "sweating" consists of causing the material to ferment to enable the seed to be more easily freed from the corky central core at threshing. The fermentation is commonly brought about by leaving the bags of heads, which still contain some moisture, on the paddock for a few days or by stacking them for a shorter time. Other methods which were more popular in the past than at present were to hang partly filled bags of seed heads on fences or to spread the heads thickly on specially constructed racks.

When sufficient sweating has taken place the seed heads are spread out on sheets and turned periodically until dry enough for threshing. With the exception of seed which falls out into the sheets and is collected directly from there, practically all seed is now threshed by header harvester, the material usually being put through the machine twice.

Final Dressing

Final dressing of the seed is usually done by plants operated by merchants, though some growers dress their own seed. Where traces of corky material remain in the seed after dressing they are sometimes removed by immersing the seed in water and skimming off the residue. This is somewhat laborious, but it has the advantage that any

Practically all onion seed is now threshed by header harvesters. The seed heads are threshed when thoroughly dry.

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partly developed and therefore non-viable seed which had not already been removed would be separated at the same time.

Two practices which have been used from time to time in other districts but which have not become popular in Marlborough are: The reduction of the number of seed stalks in the hope that the remaining ones will produce a greater total quantity of seed. The taking of more than one crop of seed from a single planting of bulbs. With the latter practice the seed stalks remaining after harvest are mown and cleared away and the bulbs left undisturbed for a second crop. This practice has the advantage that the expense of providing bulbs (which is considerable) for the second crop is avoided. However, the difficulty of maintaining seed areas free from weeds causes growers in the Marlborough district to favour the taking of a single seed crop, after which the seed stalks are usually disced before being ploughed under.

Yields

Seed yields fluctuate from season to season, but unless the weather is particularly unfavourable, yields ranging from 450lb. to 500lb. of machine-dressed seed per acre are usually obtained. Crops yielding over 1000lb. have been grown, but they are exceptional.

Of the onion seed sown in the Dominion about 40 per cent. is used in the Auckland Province and most of the remainder is divided equally between Canterbury and Wellington. A limited overseas trade in onion seed is carried on, consisting mainly of the export of surplus New Zealand seed and the importation of small quantities of seed of special-purpose varieties.

Diseases and Pests

The only diseases to be guarded against in seed crops in Marlborough are downy mildew and yellow dwarf and the only notable insect pest is the onion thrips. Overseas publications mention neck rot fungus and the onion maggot as affecting onion seed crops, but neither is recorded as being of importance in New Zealand seed crops.

Downy Mildew

Downy mildew, which is caused by the fungus *Peronospora destructor*, appears as a purplish mould on leaves and stems. Whole leaves of infected plants may become yellow and later white, and affected stems sometimes bend over. The number of plants killed by this disease may be few, its chief effect being reduction in vigour.

Mildew thrives in humid conditions such as those found in a weedy crop and for this additional reason thorough weeding of the crop is necessary. Humid weather at times brings about an outbreak of downy mildew even in a clean crop. Most growers rely on the return of dry weather to curb the spread of mildew in the crop, though some apply a fungicide in an effort to check the disease. One method is to apply Bordeaux or other copper-containing spray; an alternative is to dust plants with finely divided sulphur. Of the two methods the latter seems to be the more effective locally.

Yellow Dwarf

Yellow dwarf is a virus disease of onions which, though more serious in its effect on bulb crops, can cause a reduction in yield of seed crops. As described by Chamberlain and Baylis yellow dwarf causes leaves of affected plants to lose their cylindrical shape and become flattened and crinkled. As a result the leaves cannot stand erect, but bend over sharply, often near their bases. This is accompanied by the development of narrow longitudinal yellowish streaks, which usually extend for the whole length of the leaves. Chamberlain and Baylis emphasise that this colour symptom should not be confused with the broader, more clearly defined streaking which occasionally occurs on onion leaves and appears to be a non-infectious chlorosis. Flower stalks may be streaked and in extreme cases bent or twisted but retain their cylindrical form. Often, however, the stalks appear normal even on plants which show typical foliage symptoms.

Yellow dwarf was discovered in 1938 in onion bulb crops at Marshland (Canterbury) and in seed crops at Blenheim, and it has since been identified at Nelson and Hastings. The disease is neither seed- nor soil-borne and its survival depends on the transference by insect vectors of infective material from one plant or crop to another. In an effort to break this cycle regulations were brought down in 1939 which prohibited the growing of onion seed crops and shallots in the Marshland district; prohibited the growing of jonquils, an alternative host, in the vicinity of onion crops; and in addition required growers to destroy after harvest all stray, small, injured, or otherwise worthless bulbs. This last provision is intended to prevent the spread of infection from volunteer plants which could appear from such bulbs.

Where these measures are strictly enforced they can be, and it now appears have been, successful in eradicating yellow dwarf from a bulb growing area. In seed crops the practice is to rogue infected plants if they appear.

Thrips

The chief thrips species found on onions in New Zealand is *Thrips tabaci*. This insect is a sap-sucking one and causes a lowering of vitality, but its effect on seed yield is hard to estimate.

Though overseas publications recommend various insecticides for control of thrips in onions, trials conducted in New Zealand by Jacks and Harrison indicate that satisfactory control can be secured by the application of D.D.T. emulsion. In any case growers in this country do not consider the pest of sufficient economic importance to warrant the application of control measures.

Seed Certification Scheme

Chiefly because of its superior keeping quality Pukekohe Long Keeper was the variety originally selected for seed certification and the scheme has since been confined to this variety. Certification of onion seed was begun in 1939 and now has an important influence on seed production. The purpose of the scheme is to provide seed which is true to type, free from seed-borne disease, and which will yield bulbs of good keeping quality.

Because keeping quality of bulbs varies greatly not only among the varieties of onions but among strains, particular attention must be paid to this point. For that reason a sample of every line of seed from which bulbs are intended for seed production under certification must be supplied to the Department to be sown out in test areas. The bulbs are inspected during growth and at harvest and in addition samples are taken and stored to undergo the critical test for keeping quality. Lines which pass the keeping test and which are found to be satisfactory at field inspection are approved for planting by growers to produce certified seed.

A large proportion of certified seed is grown on contract to commercial firms. Seed which is considered likely to give bulbs of the required keeping quality is secured by firms and grown either by themselves or on contract to provide the supply of approved bulbs. Most of this seed has been obtained from the originator of Pukekohe Long Keeper, and family interests still maintain a supply. Likewise the production of approved bulbs is entrusted to growers who specialise in this phase of onion production.

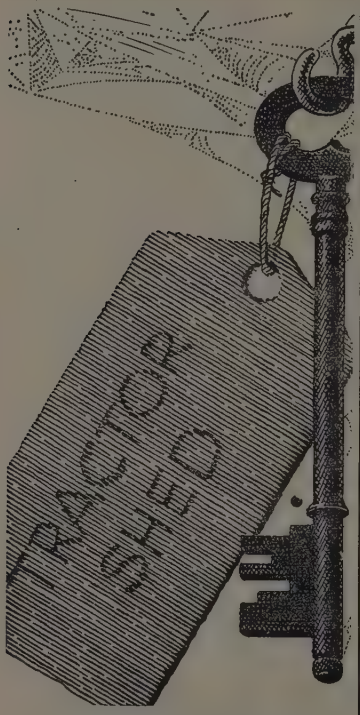
Most of the bulbs used for certified seed production are planted in Marlborough, and during growth the crops are inspected by local Department of Agriculture officers. Inspection is to ensure that isolation from flowering uncertified onion crops is satisfactory and to detect off-type or diseased plants.

Seed from crops passed at field inspection is branded and sealed when harvested and is later machine dressed under supervision before being finally sealed as Certified Pukekohe Long Keeper onion seed.

References

E. E. Chamberlain and G. T. S. Baylis: "New Zealand Journal of Science and Technology, Vol. 21, No. 4A, pp. 229A to 236A.

H. Jacks and R. A. Harrison: "New Zealand Journal of Science and Technology", Sec. A, Vol. 35, No. 2, pp. 164 to 167.



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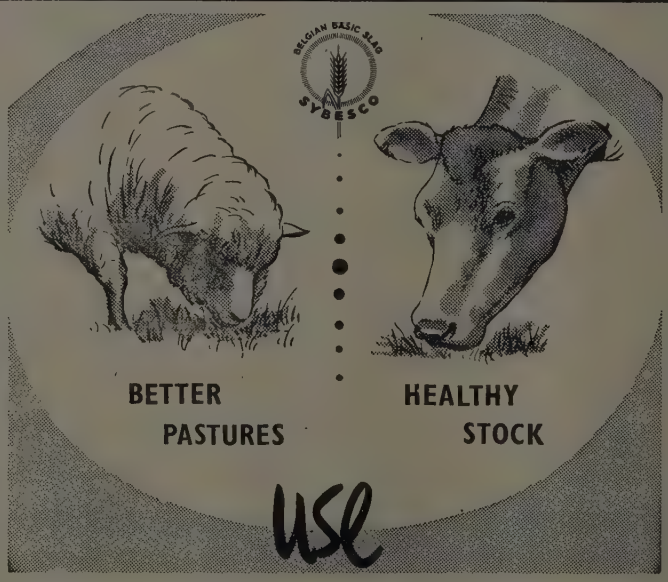

BASIC SLAG

THE PHOSPHATIC FERTILISER

Lamb Fattening off White Clover in Poverty Bay

THE production of fat lambs off almost pure stands of white clover at the Department of Agriculture's Manutuke Research Station on the Gisborne flats was described to the New Zealand Grassland Association conference in Nelson in November by the officer in charge of the station, D. P. Sinclair, and his predecessor, J. E. V. Simpson, who is now farming a property in the district. The tendency of the special-purpose pastures established on the station to become clover dominant in late summer and autumn and the marked superiority of the lambs grazing them to those produced on the old type of perennial ryegrass pasture typical of the district led to work the results of which point to the value of white clover for the fattening of store lambs in autumn in Poverty Bay.

IN the following adaptation of the two addresses the work at Manutuke is described in the first part and its application on Mr. Simpson's farm in the second part.

MANUTUKE RESEARCH STATION

The Poverty Bay-east coast area, in spite of an increasing trend toward beef cattle production, is still one of the major sources of store sheep in the North Island. Some 1,200,000 breeding ewes are carried within the area and between 80 per cent. and 90 per cent. of lambs are tailed each year, which should give approximately 500,000 wether lambs available for disposal annually.

District's Lamb Killings

The areas of flat or easy land in the district are not extensive, but they are fertile and have a benign climate, and it might be expected that intensive store lamb fattening would be a feature of their farming. However, this is not so. Feed crops are not widely grown and pasture renewal with improved species is not practised as a routine of rotational cropping, and at present lamb fattening is largely dependent on the permanent pasture which is characteristic of the district, namely, perennial ryegrass of ancient origin and a primitive, low-producing strain of white clover which evidently fixes sufficient nitrogen for the ryegrass but does not itself provide any significant amount of the total feed production. The result is that in recent years the only remaining freezing works of the district has killed fewer than 250,000 lambs at a low average carcass weight of between 30lb. and 31lb.

In 1945 the Manutuke Research Station was established on the fertile flats near Gisborne for the primary purpose of investigating facial eczema, and since then an essential part of the work there has been the study of weaned store lambs grazing on this typical permanent pasture during late summer and autumn. The work has covered every stage of growth from summer drought through the most vigorous of autumn flush, but the outstanding feature has been that under no circumstances have the lambs done well on the pasture.

Weight Gains

The best weight gain recorded was this year, when lambs put on 15lb. liveweight in 11 weeks. Actual losses of body-weight for shorter periods during facial eczema investigations are quite common, especially during the period of flush autumn growth, and on two occasions when the station has been stocked to its capacity at such time typical hogget ill thrift has been produced.

From the foregoing observations it seems reasonable to assume that dependence on a permanent ryegrass dominant pasture is mainly responsible for the poor record of fat lamb production in Poverty Bay and, therefore, if full advantage is to be taken of this ready source of store lambs available for fattening without recourse to the growing of feed crops, some more suitable type of pasture must be established.

Pastures

The question then arises: Which is the best type of pasture for fattening store lambs in Poverty Bay?

From the outset at Manutuke a variety of improved and special purpose pastures was established and used for fattening, both during spring with lambs on the mother and during autumn with bought-in stores. A great increase in meat production was obtained from all these pastures compared with the district average of lamb killings. However, more emphasis was given to production of fat lambs off the mothers and here no pasture mixture showed any clear-cut superiority, though short-rotation ryegrass and white clover appeared to be a little better than any other. In contrast the results from autumn fattening were much more variable and differences occurred which were not explainable in terms of the original mixtures sown. During the course of this work it was observed that the improved strains of white clover showed a marked tendency to dominate a sward during late summer and autumn and therein lay the explanation of better lamb growth on some of the pastures.

Trial Results

In 1949 it was recorded that this process of clover dominance was very marked in 3 of the 10 paddocks used.

Perennial ryegrass. Records of weight gains, facial eczema investigations, and hogget ill thrift indicate that dependence on a permanent ryegrass dominant pasture is mainly responsible for the poor record of fat lamb production in Poverty Bay.

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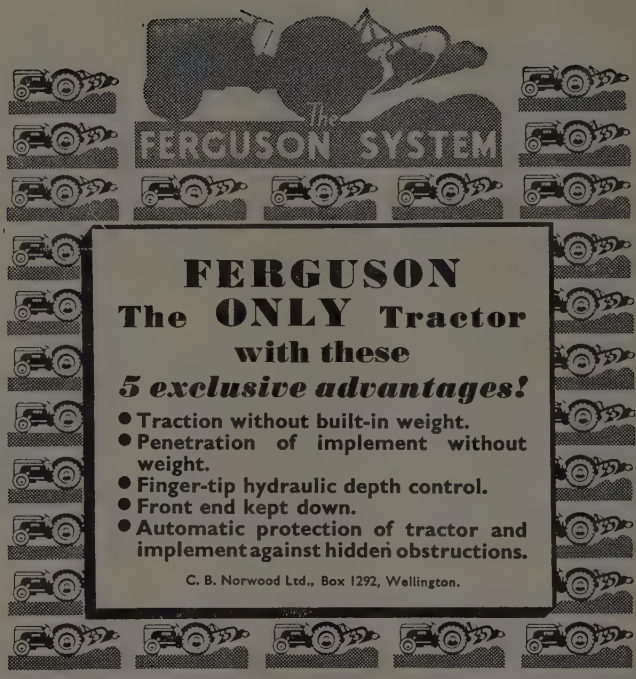

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The results from the autumn fattening trial that year, comparing clover-dominant pastures with non-clover-dominant, are shown in Table 1.

TABLE 1—1949 AUTUMN FATTENING TRIAL

Pasture	Weight gain per day lb.	Carcass weight lb.
Clover dominant		
Short-rotation ryegrass and white clover	0.40	44.5
Phalaris tuberosa and white clover	0.30	40.2
Red clover and white clover	0.30	44.0
Average	0.34	42.9
Not white clover dominant		
*Long-rotation mixture (average of 2 paddocks)	0.24	35.8
Short-rotation ryegrass and white clover	0.23	36.3
Cocksfoot and white clover	0.26	36.1
Perennial ryegrass and white clover	0.25	36.0
Mixed red clover (poor stand)	0.16	33.9
Average	0.23	35.6

* Short-rotation ryegrass, timothy, cocksfoot, white clover, Montgomery red clover, and cowgrass.

It is not possible to present any accurate measurement of the percentage of white clover in these pastures, but the term dominant means a sea of white clover and very little else.

The figures in Table 1 were more the result of fortunate circumstance than of planned experiment, but they strongly suggested that white clover was the ideal pasture plant for fat lamb production in Poverty Bay. In the 5 years since then, therefore, attention has been given to the production of fat lambs off almost pure stands of white clover. This work has been on a small scale and subsidiary to the main work with facial eczema, and maximum commercial returns have not necessarily been considered. In each case, however, medium store crossbred wether lambs with an average weight of between 55lb. and 62lb. have been used. They were purchased from a typical hill country station in the latter part of January and were put on to the clover pastures soon after arrival at the station. They were weighed at the beginning and end of the feeding period and carcass weights were recorded at slaughter. They were set stocked and, with one exception for experimental reasons, were not drenched or supplemented in any way.

The results are shown in Table 2. Where possible results from the grazing of similar lambs during approximately the same period on the old type of perennial ryegrass pasture are shown for comparison.

It was obvious that white clover consistently produced excellent lambs and was very superior to the old type of perennial ryegrass pasture for 5 years in succession, a period which covered an extreme range of very high and very low summer rainfall.

Each year from 1950 to 1952 the same lot of lambs were carried right through until May. This was necessitated by the work with facial eczema, but it is obvious from later results that such a practice is wasteful of good feed. As the lambs get heavier the growth-rate slackens and in practice it would be more economical to kill the first lot of lambs after 10 weeks or so and restock with a further lot of stores.

However, apart from these financial aspects it is obvious that white clover consistently produced excellent lambs and was very much superior to the old type of perennial ryegrass pasture for 5 years in succession, which covered an extreme range of very high and very low summer rainfall.

A further result in favour of white clover is that no evidence of facial eczema liver damage has been found in lambs grazing it, and though no serious outbreak has occurred among lambs on perennial ryegrass, some liver damage has been found and there is always the risk that one day another outbreak like that in 1938 might occur.

White Clover Best

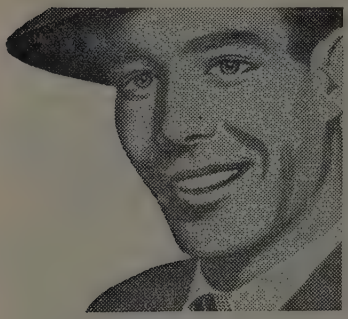
In view of these results white clover is considered the best fattening feed for Poverty Bay, but it must be stressed that to obtain similar results almost complete white clover dominance must be achieved in a pasture during late summer and autumn, with the consequent risk that the ryegrass content might be smothered out entirely. The results described were obtained from pastures in which this had happened, and before they can be recommended as a permanent proposition and their establishment and management described, it is necessary to consider their production at other times of the year.

An experiment was conducted during the spring of 1950 in which fat lamb production on the mother from a 95 per cent. white clover pasture was compared with that from the old type of perennial pasture and from an improved pasture containing a well-balanced mixture of short-rotation ryegrass and white clover.

Four acres of each were set stocked with 10 ewes and single lambs per acre from soon after lambing in mid-August to weaning in early December. At weaning a draft of fats was taken and the remaining lambs were spread

TABLE 2—WEIGHT GAINS RESULTING FROM GRAZING ON DIFFERENT PASTURES

Grazing period	No. of lambs per acre	Type of pasture	Weight gain per day lb.	Carcass weight lb.
1950				
28 January to 4 May	10	White clover	0.38	42.5
28 January to 4 May	10	Old pasture	0.12	31.3
1951				
6 February to 8 May	10	White clover	0.35	43.7
6 February to 8 May	10	Old pasture	0.08	29.8
1952				
21 January to 8 May	10	White clover	—	43.0
16 January to 28 May	10	Old pasture	0.12	29.9
1953				
21 January to 17 March	10	White clover	0.56	38.0
No comparable figures for old pasture available				
1954				
25 January to 12 April	10	White clover	0.44	43.3
25 January to 12 April	10	Old pasture	0.19	33.2
20 April to 15 June	8	White clover	0.29	37.8
20 April to 15 June	8	Old pasture	0.05	30.9



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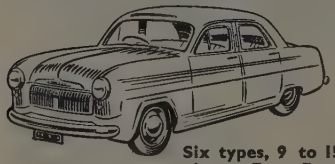

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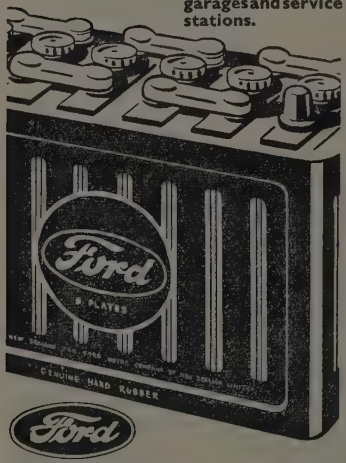

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- Wash carefully all vegetables eaten raw.
- Never throw raw liver or lungs of sheep to dogs. Cut offal into slices and boil first. Otherwise burn or bury it.
- Dose your dogs with a vermifuge every 3 months and expel the worms.
- *Rid your dog of worms now! Then it is no longer a danger to you or others.*

. . . DOSE YOUR DOG NOW

MR. FARMER . . . your co-operation, please.

4.4a

over the same areas until mid-January, when a second pick was taken.

In Table 3 production from each pasture is expressed as total percentage killed in the two drafts and average carcass weight.

TABLE 3—PRODUCTION OF LAMBS FROM DIFFERENT PASTURES

Type of pasture	Total percentage killed	Average carcass weight lb.
95 per cent. white clover ..	95	34.2
*Old-type perennial ryegrass	60	32.9
Short-rotation ryegrass and white clover	97	35.1

* Old type refers to the strain of perennial ryegrass common to the Poverty Bay district when certification was introduced.

The good mixed pasture was only a little better than the pure white clover and both were much superior to the old type of perennial ryegrass. The lack of ryegrass was no disadvantage during the spring fattening period.

Winter Grazing

There remains only the winter grazing period to be considered. At Manutuke this lasts approximately from mid-June until mid-August. During this time the improved pastures are rationed to the ewe flock during the later stages of pregnancy for a few hours each day. The old perennial pastures are used as holding paddocks for feeding hay. For the last 2 years the white clover has provided the equivalent of 350 ewe grazing days per acre compared with 600 to 700 from the good mixed pasture. To sum up, then, white clover alone is a pre-eminent pasture, except for the relatively brief winter period.

Dry matter production measurements which were carried out on the 3 main types of pasture from 1 April 1949 to 31 March 1951 and grazing records which have been converted into arbitrary ewe equivalents are shown in Table 4.

TABLE 4—PRODUCTION OF DRY MATTER PER ACRE AND GRAZING RECORDS (Ewe equivalents)

Type of pasture	Dry matter per acre lb.	Total ewe equivalent
White clover	9,600	2,350
Short-rotation ryegrass ..	12,500	2,700
Old-type perennial ryegrass	10,500	Not significant

The good mixed short-rotation ryegrass and white clover produced considerably more feed than white clover alone and carried more stock, but the big difference in dry matter production is not proportionately reflected in carrying capacity. Surplus growth of grass during spring and autumn flushes is not fully utilised and, apart from a small number of cattle grazing days, the difference in carrying capacity is largely the result of growth of ryegrass during winter. The ideal, therefore, is a pasture which is clover dominant during summer and autumn and which will produce growth of ryegrass for winter feed. As with most similar propositions it is extremely difficult to have it both ways, but to some extent it is possible, in Poverty Bay at least, by using a short-rotation ryegrass and white clover mixture.

Establishment of Pasture

In the normal dry summer in Poverty Bay short-rotation ryegrass has more the characteristics of an annual than of a perennial and tends to die out after seeding during the dry weather of December and January and, if encouraged, to come away again after the late autumn rain. Experience at Manutuke is that if this mixture is leniently grazed at the onset of dry weather, the white clover will take over and persist throughout summer and autumn and then, if it is grazed fairly hard during April to open it up, there will be regrowth of grass for winter feed. However, it does not always happen this way.

The important thing to aim at is to establish a good sward of white clover for lamb fattening, and if the ryegrass is smothered out, it can readily be re-established by oversowing, which is neither costly nor difficult. Heavy grazing to open up the sward, broadcasting 10lb. of short-rotation ryegrass, and then chain harrowing is a method which has produced excellent winter pasture at Manutuke.

The usual methods of pasture establishment are well known and need no elaboration here, but the establishment and encouragement of white clover dominance in a mixed pasture in relation to the Poverty Bay climate require some comment. There is some evidence that white clover establishes more quickly in a new pasture which is sown down after crops which have lowered the nitrogen content of the soil. For the last 2 years more success has been attained at Manutuke with white clover in pastures which have followed a succession of brassica crops than in those which have been sown from grass to grass. Otherwise the ratio of grass to clover appears to depend directly on the climate. In a wet summer such as that in 1952-53, when 10in. of rain fell in December and January, it was not possible to suppress the growth of ryegrass, but regular topping threw the balance in favour of the clover. In the dry summers typical of the east coast the clover usually becomes dominant spontaneously, provided the pasture is leniently grazed or spelled before it gets too dry, which is usually in early December. Experience has shown that it is essential to establish a cover of feed at least 6in. deep by this time. Evidently soil moisture is conserved and growth of clover continues throughout the average summer drought and usually provides fattening feed for at least 10 lambs per acre.

If, on the other hand, the pastures are eaten down at the onset of a dry period, no degree of spelling will bring the clover away until further rain falls and much of the summer's production is lost.

On the fat lamb property the surest method to guarantee a deep initial cover of feed is by early weaning. As soon as dry weather sets in and pastures show signs of being eaten down too short weaning should take place, if necessary even before the end of November. The first pick of lambs can be taken and the remainder spread

The ideal pasture is one which is clover dominant during summer and autumn and which will produce growth of ryegrass for winter feed, and to some extent this is possible in Poverty Bay if a short-rotation ryegrass and white clover mixture is used.

as lightly as possible. The ewes can be shut up on short rations until tupping.

With this procedure at Manutuke during last season (1953-54) 8 Down cross lambs per acre were topped off from weaning until early January, and then from late January until June a total of 18 store lambs per acre were fattened in two drafts, the first during a period of summer drought when feed in the district was very short and the second after the autumn flush when hogget ill thrift was prevalent. These lambs were not drenched or supplemented in any way, and they returned a total stock profit of £35 per acre in 5 months, which is perhaps the most convincing argument of all that white clover is the feed for fattening lambs in Poverty Bay.

A criticism often levelled at this type of work is that it is done only on a small scale and might not work out under practical farming conditions. Mr. Simpson, who 3 years ago went farming on his own behalf, has put a modified version of this scheme into practice and the results he has obtained follow.

PROPERTY OF MR. J. E. V. SIMPSON

The work at Manutuke has shown quite conclusively that a pasture containing a very high percentage of white clover fattens lambs well above the district average weight and well above the weight of lambs fattened on the old-type Poverty Bay perennial ryegrass and white clover pasture.

Three years ago 150 acres of old-type Poverty Bay perennial ryegrass and white clover pasture were taken over by the writer. Growth of perennial ryegrass in winter was poor, in spring it was good, and in summer the pasture became rusted and most unpalatable. In autumn after the rains the herbage was poisonous with facial eczema toxin; in fact, it was a most undesirable pasture species. White clover did not grow in winter, was suppressed by perennial ryegrass in spring, and in late summer flowered profusely and contributed very little herbage.

TABLE 5—EXPENSES AND RETURNS FROM LAMBS

Date of purchase	No.	Cost per lamb s. d.	Total cost £ s. d.
19 March	224	48 6	543 4 0
26 March	131	40 0	262 0 0
30 April	63	29 3	92 2 9
30 April	250	38 0	475 0 0
11 June	35	46 6	81 7 6
	703		£1,453 14 3

Date of pick	No.	Price received (to nearest penny) s. d.	£ s. d.	Dressed weight lb.
22 April	229	62 0	709 11 1	35.61
26 May	120	65 0	390 7 3	36.18
26 May	3	77 6	11 12 7	42.33
26 May	140	56 10	397 16 1	31.98
26 May	6	48 6	14 11 1	Class wethers
28 June	114	58 3	332 0 0	32.27
28 June	37	53 8	99 4 10	29.70
	649		1,955 2 11	
Value of 54 lambs unsold at £2 5s. per lamb			121 10 0	
			£2,076 12 11	

Stocking

During the first winter 200 ewes were grazed on 70 acres and were hard pressed. The lambs born were small and the ewes did not milk well judged by the growth-rate. On 10 December 45 per cent. of the lambs were picked, averaging 32.5lb.

This last season on 15 August [1953] 140 ewes and 150 lambs were put on to a 12-acre paddock of Certified perennial ryegrass and 80 per cent. white clover. On 1 December 64 lambs averaging 36.6lb. were picked. The substantial difference in the carrying capacity and the amount of meat produced per acre is considered to be a reflection of the difference in the clovers in the sward rather than the ryegrass.

The big difference in the weight of meat per acre and carrying capacity of the older type of pasture compared with that of the pedigree strains of ryegrass and white clover has been pointed out. Factual data such as carrying capacity and meat produced per acre are very difficult figures to obtain from a farmer with regard to any particular paddocks on his farm. This autumn figures of lambs fattened on two fields on the farm have been kept: One a 14-acre paddock with 15 per cent. of short-rotation ryegrass (pedigree strain) and 85 per cent. of white clover (pedigree strain), and another a 12-acre paddock with 20 per cent. of perennial ryegrass (pedigree strain) and 80 per cent. of white clover (pedigree strain). These two fields were available for lamb fattening from early March, but were spelled until 19 March after the breaking of the drought earlier in the month.

Costs and Returns

Table 5 shows the date the lambs were purchased, the number purchased, the price paid, the date lambs were picked, the number picked, the average price received, and the dressed weight.

The cash return from 26 acres is £501 8s. 8d. or about £19 5s. 9d. per acre, and if the value of the 54 lambs unsold on 28 June is added, the return per acre is about £24. When the total number of lambs purchased, 703, is divided into the cash return, £501 8s. 8d., plus the value of the 54 lambs on hand, £121 10s., the gross return per lamb is 17s. 8d. After allowing for cartage from the saleyards to the farm and from the farm to the works plus the cost of drenching the odd lamb, a net profit of 16s. 6d. per lamb is shown.

The figures demonstrate that the application of research work to practical farming is possible and at the same time highly profitable.

Prevention of Facial Eczema

TO avoid outbreaks of facial eczema the following precautions should be adopted immediately warm rains follow a long period of dry weather:—

For Lambs

Send killable lambs to the works immediately rains fall; transfer remaining lambs to brassica crops or to pure white clover swards. If these are not available, lambs should be put on the roughest pasture, but some cases are likely to occur under these conditions.

For Older Sheep

If sheep cannot be grazed on brassica crops or pure clover swards, concentrate them at not fewer than 100 sheep per acre. Feed hay at about 2lb. per ewe if possible and provide adequate water. Even when no hay is available starvation for a fortnight will not seriously harm most mature sheep.

For Cattle

Feed brassica crops, but if these are not available, concentrate cattle at not fewer than 20 per acre. This will cause dairy cows to dry up unless they are fed adequate quantities of silage or other safe succulent fodder. Alternatively, place cattle in the roughest paddock available for the first week after rains fall and then rotate them at short intervals through the longest pasture available.

If further advice is required, local officers of the Department of Agriculture should be consulted.

Control of Grass in Lucerne

By J. N. FITZGERALD, formerly Research Officer, Department of Agriculture's Invermay Research Station

THE area of lucerne grown on the Taieri Plains has never become extensive, as establishment and weed control are major difficulties. When the crop is established the life of the stand is often curtailed by the ingress of volunteer grasses, mainly ryegrasses, browntop, and *Poa annua*. Control can be obtained in part by cultivation practices such as grubbing, but the result is often only temporary and it can be said that the cultivation aids the grasses as well as the lucerne, especially in an area with well-distributed rainfall. On the Taieri Plains volunteer ryegrasses are a serious problem in relatively young lucerne stands, as is browntop in older stands.

WITH the establishment of large areas of lucerne at Invermay Research Station several field trials were laid down to ascertain the effect of certain chemical weedkillers on lucerne and their efficiency in controlling volunteer grass growth. The weedkillers used were T.C.A. and I.P.C., which have shown distinct promise in the control of grassy weeds. The trials were designed mainly to measure the tolerance of lucerne to these chemicals, and cuts from each plot were taken at the same time as were normal hay cuts for plots yields. In these trials the stages of plant growth at which applications were made were pre-emergence, after the seed-leaf stage, and maturity. The trial results will be presented under these headings, all application rates being given as T.C.A. and I.P.C. equivalents and not as acid equivalents.

A trial plot of lucerne in which sodium salt of T.C.A. was applied in July at 80lb. per acre. The control plot is in the background. The photograph was taken 2½ months after application.

In this trial plot of lucerne I.P.C. was applied in the foreground area at 16lb. per acre. The control plot is in the background. The photograph was taken 2½ months after application.

Stages of Application

Pre-emergence

T.C.A. and I.P.C. were applied to the plots 2 days after the lucerne was drilled. The time of sowing was January 1953 and the application rates were 5lb., 10lb., and 20lb. per acre of T.C.A. and 1lb., 2lb., and 4lb. per acre of I.P.C. During autumn seedling ryegrasses, Yorkshire fog, chickweed (*Stellaria media*), and shepherd's purse infested the trial area. In the plots with 20lb. per acre of T.C.A. no grasses were growing, but some chickweed was present. The plots with 5lb. and 10lb. per acre were little better than the control plots. By the following November seedling grasses were present in the 20lb. per acre plots, the effect of the T.C.A. having disappeared. At the first cut of the season there was no difference in the yields of the plots. The results from I.P.C. were better; no seedling grasses or chickweed appeared in the 4lb. per acre plots and only a small amount was present in the 2lb. per acre plots. Throughout the winter no chickweed or grass grew in the plots and by spring the plots were clean. I.P.C. has a slower action than T.C.A. and tends to remain longer in soils high in colloidal content and especially under cool soil conditions.

At the first cut there were no yield differences between the I.P.C. treatments. By this time the control plots

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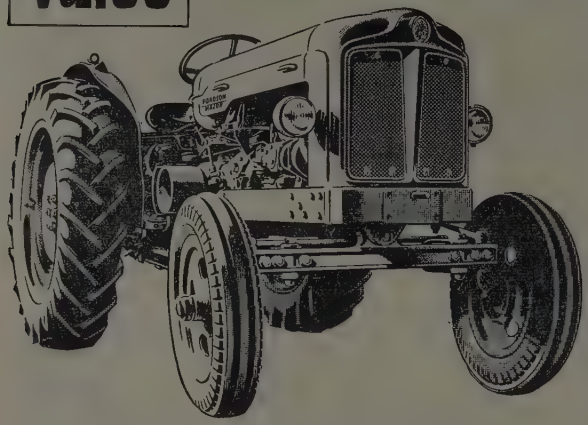

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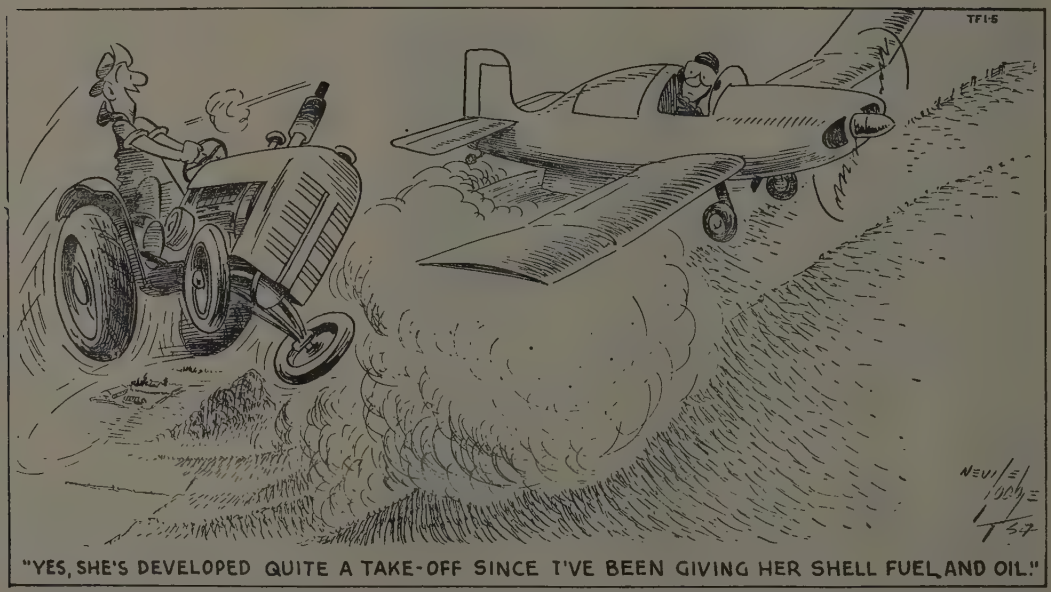

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were heavily infested with ryegrass, Yorkshire fog, *Poa annua*, and other weeds.

After the Seed-leaf Stage

The trial of applications after the seed-leaf stage was laid down in a different season and on a different area from those in the pre-emergence trial. The rates of application of I.P.C. and T.C.A. were the same and the treatments were applied when the plants had developed their true leaves and were 3in. to 4in. high. Twenty pounds of T.C.A. per acre caused severe leaf burn and distortion of the young plants and in the following spring at the first cut the plants were 2in. shorter than those in the control plots. However, the difference in plot yields was not significant. Plants in the 5lb. and 10lb. per acre plots were similar to those in the control plots. I.P.C. applied at 4lb. per acre caused some leaf burn and distortion of the plants, but healthy new growth soon appeared and by the time of the first cut there was no evidence of any growth check. With the high rates of both T.C.A. and I.P.C. there was a yield reduction of 6 per cent., but this was not significant. The effect of T.C.A. at 20lb. per acre could be seen in the growth after cutting, but this was short lived and by the second cut there was no visible effect. The trial area was not weedy and seedling grass growth was controlled in all treated plots.

Maturity

Two trials were laid down on mature plants at different times, the second one with higher rates of application than those used in the trials previously described. In the first trial the rates of application were the same as in the previous trials, applications being made in December, when the plants were about 6in. high after the first cut for the season. Twenty pounds per acre of T.C.A. caused severe leaf burn and a growth check, the plants being 2in. shorter than in the control plots. Yield reduction at cutting was 10 per cent., but later cuts showed no difference from those from the untreated plots, though regrowth after the later cuts was slow. Ten pounds per acre of T.C.A. caused a 3 per cent. yield decrease in the first cut. Grass control was good, except that established ryegrass plants appeared to be unaffected by the 20lb. per acre application. Four pounds per acre of I.P.C. caused very severe leaf burn and wilting and a growth check, the plants being 4in. shorter than those in the control plots. Two pounds per acre caused a 2in. height reduction and similar leaf burn. These effects are partly due to the strong aromatic solvent contained in the liquid form of I.P.C. used in these trials. However, new growth quickly came away and when the plots were cut there was actually a slight yield increase from all the treated plots. No height differences were observed in the regrowth except that the plots treated with 4lb. per acre of I.P.C. were slower to begin growth. Rates of 5lb. per acre of T.C.A. and 1lb. per acre of I.P.C. were not efficient in the control of seedling grasses.

As mature grasses and browntop were more difficult to control, it was considered that higher rates might be necessary; also that if T.C.A. and I.P.C. were applied in winter while the lucerne was dormant, better control of the spring seedlings would be obtained with less damage to the lucerne. Therefore a further trial was laid down with T.C.A. applied at 20lb., 40lb., and 80lb. per acre and with I.P.C. at 4lb., 8lb., and 16lb. per acre. The time of application was July 1953, when the lucerne plants were 2in. to 3in. high and in the winter dormant stage. The lucerne began its spring growth in the latter half of September and as was expected the effect of the high rates of T.C.A. and I.P.C. was drastic (see illustrations). Two months after the application the lucerne treated with 20lb. per acre of T.C.A. was simliar to that in the control plots and at 40lb. per acre the lucerne was stunted and wilted. T.C.A. at 80lb. per acre caused very retarded growth and leaf bleaching, but the plants were still making some growth. Similarly with I.P.C. at 4lb. per acre the lucerne was like that in the control plots and the 8lb. per acre plots were of similar colour to the control plots, but 2in. shorter. In the 16lb. per acre plots the lucerne was only half the size of that in the control plots, but still retained its natural colour. Also some white clover plants in these plots appeared to be unaffected.

By the time of the first cut in late October the treatment differences had largely disappeared and the plants looked normal except those in the plots treated with the high rates of both weedkillers. Three cuts in all were taken that season and the yields from the different plots are presented in the table below.

In the first cut yields were all significantly (1 per cent. level) reduced, especially with treatments 4 and 7, though 16lb. per acre of I.P.C. was much less severe that 80lb. per acre of T.C.A. However, by the second cut recovery was nearly complete and only treatments 3 and 4 were significantly (5 per cent. level) less than the control. At the third cut all treatments were similar to the control with no significant differences in yield. Regrowth after the first cut showed no further treatment effects and the lucerne in treatment 4 was normal but shorter than that in the other plots. As expected grass control was 100 per cent., though by the time of the second cut seedling grasses were appearing in treatments 2 and 5, but this growth was very limited. Best grass control was in treatments 3 and 4. Volunteer clover appeared in all plots as well as odd weed plants, especially where the lucerne was checked by the heavy rates.

YIELDS OF LUCERNE (DRY MATTER IN LB. PER ACRE)

Treatment per acre	Cut 28/10/53	14/12/53	2/2/54	Total
1. Control	3,670	2,540	1,630	7,840
2. T.C.A., 20lb.	2,570	2,620	1,860	7,050
3. T.C.A., 40lb.	1,690	2,160	1,570	5,420
4. T.C.A., 80lb.	550	1,890	1,780	4,310
5. I.P.C., 4lb.	2,760	2,690	1,720	7,170
6. I.P.C., 8lb.	2,690	2,670	1,610	6,970
7. I.P.C., 16lb.	1,830	2,700	1,760	6,290

This trial shows to what extent lucerne can tolerate T.C.A. and I.P.C., though dressings as high as 80lb. per acre of T.C.A. and 16lb. per acre of I.P.C. are at present uneconomic. It would appear that 30lb. per acre of T.C.A. should be sufficient for grass control with the minimum damage to lucerne. As these chemicals act primarily as root killers, spraying after grubbing a paddock in winter may give better control. Final observations a year after the application showed that the plots were all free of grass growth, though some seedlings were present in the low rate plots. The other rates of application will keep lucerne free from serious grass growth for another year and perhaps even longer.

Conclusions and Recommendations

T.C.A. at up to 20lb. per acre and I.P.C. at up to 4lb. per acre can be applied to lucerne as a pre-emergence treatment. I.P.C. tends to give better grass control than T.C.A., as its effect lasts longer in soils high in colloidal content at low temperatures and in one trial it gave very good control of chickweed.

Application of T.C.A. and emulsifiable I.P.C. that contains an aromatic solvent to seedlings and semi-mature plants is not recommended, as the growth check is too severe. These two chemicals should be used at pre-emergence, but I.P.C. as a wettable powder can be applied at any stage of growth.

On mature grasses T.C.A. has given better results than I.P.C. and rates of 20lb. to 30lb. per acre are recommended, depending on the severity of the grass infestation.

For full grass control and least damage to lucerne winter and early spring applications have proved to be the best.

Applications to lucerne after a cut has been taken should be made only if necessary, as there is a 10 to 20 per cent. yield reduction in the following cut.

Application of T.C.A. after grubbing a paddock may hasten the kill of grass, as the roots would be exposed.

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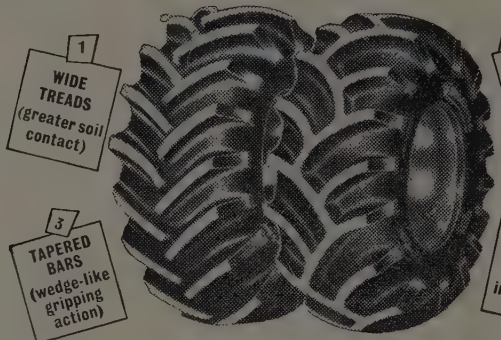

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Survey of Aerial Topdressed Tussock Land in South Canterbury

By H. M. SIEVWRIGHT, Fields Instructor, Department of Agriculture, Lake Tekapo

A SURVEY of the effect of aerial topdressing and oversowing tussock land was started recently in South Canterbury, the object being to ascertain not only the extent to which this has been done, but also its effect on both the tussock land and livestock.

SOME 10,000 acres comprising nine areas have already been studied. This area represents only a small portion of the total area that has been topdressed. Though the work is only in its early stages, striking results from aerial topdressing and oversowing are evident as the result of activities during 1950-54.

Fertilisers used have been superphosphate, reverted superphosphate, and "super. compound" at 1cwt. to 2cwt. per acre together with 3lb. to 10lb. of clover seed per acre. Molybdenum at 1oz. per acre plus 20lb. of lime per acre have also been included in some cases. The seed used has been white clover, Montgomery red clover, suckling clover, subterranean clover, and alsike, much of it being "seconds" from certified lines.

Steady advances have been made in the mechanics of aerial topdressing. Today the bulk handling of fertilisers is widely adopted. Fertiliser is dumped on a base of lime alongside the landing strip and "loader dozed" into the hoppers of the aircraft doing the spreading.

The tussock lands have no native clovers. Oversowing is done to introduce clovers to the areas and topdressing aims at stimulating them once they are established. Apart from their feed value legumes fix sufficient nitrogen to stimulate the grasses and herbs. It will probably be a long time before the fertility of the areas studied will be raised to a sufficiently high standard to ensure success of oversowing with grasses.

The areas studied have ranged from 1400ft. to 2500ft. above sea level. Two areas were burnt just before topdressing, but it is doubtful if this was warranted, as no seeding was done and in any case the destruction of fire-tender plants and moisture-holding humus is harmful. In general, this country is lacking in humus owing to the short growing season for plants to produce herbage and roots; also the season of suitable temperature and moisture for the decomposition of organic matter to humus is short, often only 3 months of the year. Concentration of cattle on the area before topdressing is a wiser practice than burning.

On one area rank growth had been removed by cattle and the area grazed with a heavy concentration of sheep before the application of reverted superphosphate. Results were very good. This was an area of good mixed fescue tussock and silver tussock with other native species, clover, browntop, and cocksfoot. With a rainfall of 30in. and little drying up by wind and sun browntop was on the increase. One of the areas treated was in the 30in. rainfall belt and on a sunny face of fescue tussock 2200ft. to 2500ft. above sea level. This area, which has only a shallow depth of soil, had not been spelled from grazing and was almost lacking in clover. It was successfully oversown with 2cwt. of reverted superphosphate and a 10lb. mixture of white, suckling, subterranean, and Montgomery clovers, "seconds" of seed from certified lines. Generally the topdressing of fertiliser on its own is recommended only where there is sufficient clover in the sward to ensure a response.

As far back as 1938 pilot plots were laid down to gain information on responses. These showed that the application of phosphate at 1cwt. to 2cwt. per acre resulted in a marked stimulation of the existing clovers. This testing before topdressing can be recommended in all cases.

Observations of the effects of the recent aerial topdressings confirmed the results from early tests.

In regions where the annual precipitation is 23in. or more, aerial topdressing has caused a marked stimulus to clovers. This has been maintained for 3 years, after which the tendency of clovers to fall off in production is very marked. Where a second application of superphosphate has been

Heading photograph: Auster Airviews.

Upper—Tussock grassland on which trials have shown that clover can be established successfully. Lower—White clover established and growing strongly between tussocks. The tussock lands have no native clovers and oversowing is done to introduce them.

applied the stimulus to clovers is not as marked as after the first application. On an area sown with lime and molybdenum no responses were evident. On areas where clover alone has been sown results have been most unsatisfactory owing to the lack of phosphate. Tussock plants are noticeably healthier and more vigorous where legumes are thriving. Browntop also grows more vigorously as the result of the effect of legumes. It apparently becomes more palatable, being more readily eaten by cattle in particular. The effect of superphosphate appears to be more prolonged on blocks where cattle have been run for a number of years before topdressing.

Establishment of clover seedlings and stimulation of existing clovers are limited by dry seasons, but as conditions become favourable responses are generally seen. As a rule late autumn or winter topdressing is favoured to ensure that plant roots develop before the normal dry weather sets in. On the higher rainfall areas responses on the steeper, sunny faces were greater than on the more fertile flats.

There are indications that where considerable areas have been done it may be necessary in some instances to change the breed of sheep because the feed has changed to a more succulent form after aerial topdressing.

Research

Investigations at present under way aim at determining the time, rate, and frequency of applications of seed and superphosphate considered most effective. The effect of adding lime before superphosphate is applied will also be studied. It is required also to know the period of spelling from stock necessary to allow for the best establishment of seeded areas.

In the field of trace elements trials are to be laid down to compare possible sulphur responses with phosphate responses. Other trace elements will also be investigated in specially designed trials.

The survey to date shows that:—

1. The application of seed alone is not worth while; it must be sown with superphosphate.
2. The application of 1cwt. of superphosphate followed with a further application in 3 years is more effective than the application of 2cwt. with longer periods between dressings.
3. Aerial topdressing of tussock lands can be used to clean up browntop in particular; cattle and sheep will then eat it and thus do away with the fire risk, consolidate the soil, and spread clover seeds. Without topdressing browntop becomes very rank and unpalatable.
4. Of great importance is the fact that the increased growth due to aerial topdressing must be grazed.

A Folding Wheelbarrow for Moving Beehives

IT has always been laborious for a beekeeper to move beehives singlehanded, and the wheelbarrow described here by R. G. Nairn, Technician, Department of Agriculture Animal Research Station, Wallaceville, has been so designed that a beekeeper working alone can pick up heavy beehives and move them to a motor truck for conveyance to another site. A tier of four supers with combs of honey may also be picked up and wheeled in the same way. Also the barrow will enable a beekeeper to work a good apiary site which would otherwise not be considered practical because a motor vehicle could not be brought nearer than ½ chain from the hives. In addition it is useful for lifting to one side and replacing a hive of two or more stories when a floor board is being renewed.

A 4-story hive, clamped in position, being wheeled over rough ground.

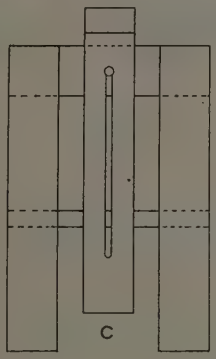
THE barrow is versatile. It is made to open out to go around a beehive, on which it is clamped. The hive can then be picked up and wheeled away. The barrow may be used as an ordinary wheelbarrow by the addition of a hive body and floor board, it can be used as a stretcher, and it can be folded.

Construction

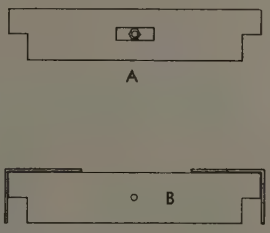
As illustrated, the trams or shafts, which are of 3in. x 1½in. timber 6ft. 3in. long over-all, are jointed 33in. from the front end and are held together by a pair of 24in. strap hinges fixed on the outside faces. The original pins in the hinges are replaced by 5/16in. removable bolts.

Two cross-bearers of 3in. x 1½in. timber are fixed 8in. apart between the shafts to the rear of the wheel. Also two ⅜in. steel tie rods between these bearers tighten the shafts to the cross members and keep all rigid.

A box 8in. x 20in. x 10in. is fixed between the bearers, and is useful for carrying spare parts and also provides lateral bracing.

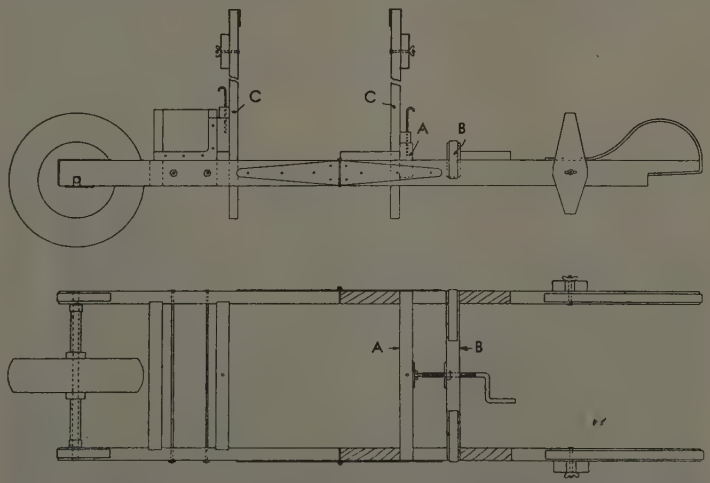


Cross-bearers A (front) and B (rear) and supporting frame C.



Wheel

The wheel, a disc type with ball bearings, will take a 16in. x 2in. pneumatic tyre and is superior to an iron-tyred wheel. Because its axle fits into slots with removable pins or clips, the wheel is quickly detached.



Plan of apiary wheelbarrow. A—Front cross-bearer. B—Rear cross-bearer. C—Supporting frames.

Clamping Device

The hive is held in place behind the cross-bearers already described and between the shafts by two additional cross-bearers (A and B on the diagram) each 4in. x 1½in. which go between the shafts at the rear of the hive. They are loose and to prevent them falling through each has a nib on the end 1½in. long and 2in. deep which rests on top of the shafts. The rear bearer B has a piece of heavy strap iron fixed to the top and bent at right angles to fit over the outside of the shaft. The bearer is designed to keep the shafts from parting or coming together and also to be a transom which will resist the pressure of the clamp.

Pressure Screw

A pressure screw is made by cutting a Whitworth thread for 6in. from one end of a ⅜in. steel rod and making two right angle bends at the other end to

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The wheelbarrow folded up for easy transport.

The wheelbarrow converted to a stretcher for carrying a hive over rough ground.

form a handle so that the screw may be turned by hand. The screw runs through a nut welded on to a piece of 3in. x 1in. steel plate which is fixed to the centre of the cross-bearer B.

The loose bearer A in front of B is a follower. In the centre of it another plate with a larger nut is welded to take the end of the screw.

To resist the rearward pressure of the screw the nibs of the rear cross-bearer bear against two pieces of 6in. x 1½in. timber fixed with heavy screws to the top of the shafts.

The front cross-bearer bears against two similar blocks, but only when no hive is clamped between the shafts.

Handles

The ends of the shafts are shaped with pieces checked out on the lower edges. Two hand grips are made from pieces of 1in. pipe bent to form loops. The ends are flattened and are screwed to the tops and ends of the shafts. When being wheeled the barrow is nearer horizontal than it would be if the ends of the shafts were gripped.

Legs

Short legs are bolted to the outside of the shafts and tightened by wing nuts. The bolts through the legs are off centre and the legs may be turned end for end to give another height or they may be turned parallel with the shafts.

A hive being wheeled up a plank and on to a lorry.

Uses of Barrow

The hive should be prepared for moving in the usual way. Then the rear cross-bearers on the barrow are removed and the barrow is moved into position in front of the hive.

The hinged shafts are opened out to allow the barrow to be drawn backward so that the shafts may be closed on each side of the hive. After the cross-bearers are put into position the screw is tightened to thrust the hive forward and hold it securely against the front cross-bearer. The barrow can now be wheeled away. The hive wood is not bruised or marked in any way, but is gripped so firmly that even the heaviest hives are immovable when wheeled over the roughest ground. When not in use the locking device is carried in the box across the bracing.

Loading on to a Motor Truck

It is fairly easy to wheel the loaded barrow over a grass paddock and up a 12in. x 2in. plank to the deck of a truck. Though it is possible for one man to move a 4-storied hive packed with honey, the usual practice would be to shift 2-decked hives.

A suitable landing platform on the truck is made by opening the tail-board out level and supporting it by two uprights from the ground. Planks, one on each side of the truck, are then laid from the tail-board to the ground so that the barrow may be wheeled up one plank, be detached from the hive, and then be wheeled

down the other plank. It is not very difficult to move hives along the deck, but as an aid when hives are being packed on the second tier they may be slid or wriggled along a short plank 9in. x 1½in. x 6ft. laid down from the top of the first tier to the deck. This would save a direct lift.

Moving Unfastened Hives

Where 3- or 4-storied hives have to be moved a few feet in the apiary provision has been made to avoid the necessity of nailing the supers together with battens.

For vertical supports two frames (C in the diagram) of 3in. x 1in. timber 16in. wide and 26in. high are made to fit in the barrow in front of and behind the hive before pressure is applied with the screw. On each frame a 4in. x 1in. board with a slot cut to take a bolt and wing nut provides an upright which can be adjusted down the centre.

Sometimes the foundation of a 4-storied hive collapses through the weight and leaves the hive with a precarious lean.

One man with the barrow may clamp it around the hive, move it forward, renew the foundation, and replace the unit without straining his back.

Portability of Barrow

The barrow is designed to be partly dismantled for easy handling in transport.

First the two pins or clips are drawn and the wheel detached. Then the shafts can be folded back on themselves. This compact unit with the spare parts should be easily packed on a loaded truck.

It is claimed that the use of the barrow allows hives to be picked up and moved faster than when they are manhandled. Heavy lifting and carrying of hives is also reduced, which must be a major consideration with many beekeepers.

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Drilling Pastures with an Adapted Coulter

By J. M. HOPKINS, Instructor in Agriculture, Department of Agriculture, Levin

THE orthodox method of sowing pastures on the majority of farms in New Zealand is to broadcast the seed on a rolled and prepared seed-bed. Other methods of establishing pastures are also practised, mainly in the arable districts of the South Island. An interesting method of obtaining complete coverage of grass and clover mixtures is by drilling with the standard grain drill but using a specially adapted coulter which is similar in appearance to an ordinary grain or turnip coulter, but which has a broad, shoe-shaped flat base, with an inverted V spreader inside the mouth of the coulter.

WHEN grass and clover mixtures are sown with the drill the seed and fertiliser are spread in two flat bands under each coulter and just under the surface of the prepared seed-bed. Germination of seed is in narrow lines over the whole field and these lines soon disappear as growth progresses, with final complete coverage of the whole field surface.

The illustration shows a pasture drilled with the adapted coulters on a Levin farm during the early autumn of 1954, the photograph being taken approximately 2 months after establishment and after one grazing had been taken off the area. Complete establishment and coverage have been obtained with this pasture.

Periodic inspections of the pasture prompt the following general observations.

The seed-bed for pasture drilled with the special coulters must be particularly well prepared and should be free of rubbish or trash which would tend to block the coulters. Good, clean seed-beds are desirable with any method of grass seed sowing, so that this requirement when the adapted coulters are used is no additional disadvantage.

Where seed-beds have been well prepared and moisture conserved the grass and clover seeds are placed in or near this moisture layer and germination is particularly rapid. This was very noticeable with the Levin pasture, the germination and initial growth being more rapid than those of broadcast pastures in the same locality.

Both the seed and fertiliser are placed in contact with one another and with soil moisture, which assists in germination and in rapid establishment after drilling. Rapid establishment also suppresses weed growth.

Though the drilling of pastures as described in this article is extremely uncommon in North Island districts, the method appears to have merit on some of the lighter and more friable soils and particularly when conditions are drier than normal in early autumn.

Complete establishment and coverage have been obtained with this pasture drilled with the adapted coulters on a Levin farm.

Development in the Lower Clutha Basin

WITH some additional drainage and adequate maintenance of existing drainage systems there is still scope for increased production from the lower Clutha basin. In this article J. G. Richards, Instructor in Agriculture, Balclutha, and K. L. Mayo, Drainage Advisory Officer, Invercargill, both of the Department of Agriculture, give a brief description of the three regions which comprise the basin and also give examples of the production being obtained by some farmers in the area.

THE flow of the Clutha River, which has for its catchment area the greater part of the inland mountain region of Otago, contains a large quantity of alluvium, the deposition of which has built up a large delta. This delta can be divided into three distinct regions.

1. The island of Inchclutha, confined on the north by the apparently more stable Matau branch of the river and on the south by the swifter flowing and more direct Koau branch. The island has an area of approximately 8000 acres.
2. The northern portion, roughly triangular, with the Matau branch of the river as the base and the margins of the rolling downlands bordering Lake Tuakitoto as the sides. This area comprises some 8000 acres of potentially productive land.
3. The Paretai region to the south of the Koau branch of the river and bounded by the Kaihiku Hills. It comprises approximately 7500 acres.

Island of Inchclutha

The most intensively farmed area of the Clutha delta (and of South Otago) is Inchclutha, which is an island 8 miles long and of an average width of 1½ miles. Its soils are mainly river silts, but there are some sandy and peaty areas. The greater part of the area is highly fertile and the soils are easily worked, drain freely, and are capable of producing excellent root and fodder crops. However, at its seaward end a constant high water-table is a limiting factor to plant growth.

The main farming system is dairying for cheese production, but revenue is also obtained from the sale of fat lambs, wool, fat cattle, and potatoes. Since the war some market gardening has developed.

The island is a well-developed farming area, but by the adoption of better management methods, which would include adequate maintenance of existing drainage systems and weed control, increased production is possible. On the very low lying areas pumping stations and stopbanks with outward floodgates would be desirable.

On a well-developed farm of 100 acres it should be possible to run 50 cows and replacements and 70 to 80 ewes. With practically no pasture growth in winter, supplementary crops of chou moellier, soft turnips for early feed, swedes for the bulk of the feeding, and mangolds for late feeding would occupy approximately 12 acres. Between 8 and 10 acres could be saved for hay and it should be possible to grow 6 acres of main crop potatoes. If sheep were not run and no potatoes grown, dairy cow numbers should be between 65 and 70.

Lake Tuakitoto Region

Lake Tuakitoto, which covers approximately 4000 acres, stretches from Kaitangata to Lovells Flat. The catchment area is approximately 67 square miles, but some 4300 acres bordering the lake are capable of being brought into production. The development of these low lying, swampy borders depends on the lowering of the water-table. At the Kaitangata end locks have been constructed to prevent tidal water from entering and to assist in keeping the lake at a level permitting several hundred acres to be grazed in summer by cattle.

Soil samples from the lake bed show that the soil is similar to that of the surrounding country and there is evidence that the Clutha River has from time to time inundated the area.

The farmed areas show signs of being waterlogged most of the year owing to poorly maintained outfall drains and the inability of the farmers to lower the level of the water in these drains without the installation of pumps. Further field drainage by tile drains or a combination of tile and mole drains to supplement the open ditch network may be necessary in parts of the area where an impervious subsoil appears to exist.

An example of what can be achieved by development of the land is shown on a farm near Benhar township. The farm comprises 480 acres of downland and 253 acres of flats. This flat land consists of two areas of 121 acres and 132 acres; most of this land was formerly subject to flooding by the lake, but is now separated from the lake by two earth dikes. Of the 121-acre area, 30 acres had been partially developed, the remaining 91 acres being in niggerheads and rushes. A 27 h.p. pump was installed in February 1950 to cope with surface water and

HEADING PHOTOGRAPH: Development of land on the Waitepeka Farm Settlement in the Paretai region has first involved drainage and then ploughing and the growing of swedes. The shaded portion of the map indicates the area described in the article.

in March of that year 70 acres of the rush and niggerhead swamp were ploughed with a swamp plough and then disced. After a winter fallow 1 ton of lime was applied in spring. Subsequent working with discs and a clodcrusher enabled swedes to be sown in ridges in late November at 16oz. per acre with 3cwt. of reverted superphosphate. The resulting crop fattened 178 bullocks from June to October and it was also necessary to purchase an extra 100 store cattle to utilise the crop fully.

With the feeding of the swedes completed the ground was disced and the clods were crushed and chou moellier was sown in ridges at 2½lb. per acre with 3cwt. of reverted superphosphate. The land was disced in preference to ploughing, because ploughing would have brought semi-decayed vegetation to the surface and created difficulty in further working.

After utilisation of the chou moellier crop 45 acres of the 70 acres were sown to pasture broadcast in January 1953, the mixture comprising 30lb. of short-rotation ryegrass and 3lb. of white clover seed; the remaining 25 acres grew a swede crop. This crop fed 178 bullocks from 1 June to 13 July 1953. Good results obtained with short-rotation ryegrass in the past were the reason for using this pasture mixture. The reason for not regrassing all the 70 acres was that the 25 acres sown in swedes were not sufficiently consolidated.

The second area, of 132 acres, is being developed in the same manner. The cost of erecting the stopbanks and installing the two pumps was approximately £3000.

The stock carried on the total area of 733 acres at 30 June 1953 comprised 1800 ewes, 710 hoggets, 60 wethers, and 179 cattle of 2 and 3 years. During the 12 months ended 30 June 1953, 189 cattle were fattened.

Paretai Region

The Paretai region of about 7500 acres once formed part of the Otanomomo Estate. In 1913, 2000 acres were subdivided for closer settlement and in 1945 a further 1850 acres known as the Waitepeka Farm Settlement were purchased for the settlement of ex-servicemen. This area consists of both high, dry ground and low lying ground and the subdivision provides for 10 dairy farms of approximately 140 acres each and one sheep farm of 450 acres. Development so far has been confined to the swampy areas and has embraced primarily the construction of new drains and the renewal of the old system of drainage, which had ceased to function.

Drainage has been followed by ploughing and the growing of swedes, on which cattle have been fattened, and finally the sowing of rape and grass. One major problem has been the presence of timber in many parts and its removal has added to the costs of development. A further problem on one area was the huge niggerheads which had to be removed, windrowed, and finally burnt. During the drying out of the niggerheads the spaces between windrows were sown with turnips and grass for cattle feed.

It is expected that the dairy farms will carry 60 cows and replacements. Examples of the carrying capacity of the district are two farms, one of 175 acres which carries 70 dairy cows and replacements and produces winter milk and another of 92 acres which carries 60 cows but where replacements are purchased. The latter farm supplies milk to a cheese factory. On it 11 acres of hay are saved each year and 10 to 12 acres of swedes are grown for winter feed.

The Paretai region has been reasonably well drained with a network of open ditches which, if they are kept clean and if pumps are installed, may be all the drainage required on the peaty soil. By stopping the pumps and allowing the water-table to rise, as is done in the Kerepehi area on the Hauraki Plains, some irrigation of the subsoil could be obtained during summer.

The total area of the Clutha basin is approximately 23,000 acres. If additional drainage work is done in some parts, all existing drainage schemes are adequately maintained, and up-to-date farm management practices are adopted, it is considered that the region can become one of the highest producing areas in the South Island.

Subdivision on Dairy Farms with the Hunter Fence

THAT up to £200 per mile can be saved by the erection of the Hunter fence on hill country and that the fence itself is both lasting and efficient have been proved by farmers, particularly on southern Hawkes Bay hill areas, where this type of fencing was evolved. A Levin dairy farmer with mainly flat terrace and some easy rolling country believes that the Hunter system of fencing has application on his type of farm, and in 1953 a number of subdivision fences and one short boundary replacement fence were erected.

To date these fences have proved to be most efficient in confining stock and have given excellent stock and pasture control. With increased confidence in the fence, the farmer envisages further subdivisions, even to the extent of replacing the bull paddock fence with a similar system. The accompanying illustration taken on the farm shows a Hunter type of fence with the posts placed at ½ chain intervals and with up to 10 chain "battens" between posts. Of the 6 wires, a barbed wire is placed at the bottom and one second from the top.

On flat or rolling country the fence is easily erected, either with concrete or wooden posts and chain "battens", and is quickly attached with the special locking clips supplied. The Hunter fence is of the true swing type, and from observation on this dairy farm it would appear that the particular system has good application on flat and easy country and that the efficiency and saving in costs are on a par with those on the more difficult hill areas.

A full description of the Hunter fencing system was given in the November 1950 "Journal".

—*J. M. HOPKINS,*
Instructor in Agriculture,
Department of Agriculture,
Levin

Perennials Give Year-round Colour

Some of the perennials discussed in this article are used in the floral clock at Christchurch.

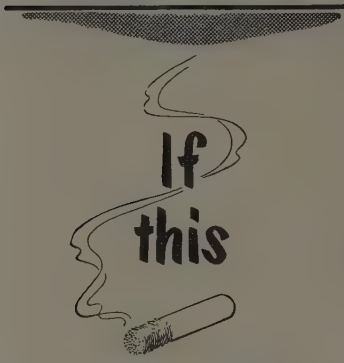
PERENNIAL plants can be used in many ways in the flower garden. Most of them flower during summer and die back to the ground in winter, but some bloom during winter and early spring. Others have attractive foliage which remains colourful and helps to brighten the garden in the off season. In the following article K. H. Marcussen, Horticulturist, Department of Agriculture, Christchurch, discusses some of the subjects in the latter group and how they can be utilised to the best advantage. The section on flower garden work for April is by M. Joanna Lockie, Horticultural Instructor, Department of Agriculture, Auckland.

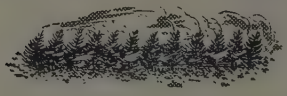
THE first sign of spring is when the early bulbs begin to flower and the garden gradually comes to life. A great variety of bulbous plants is available to extend that season and they are followed by the wealth of herbaceous perennials which flower in succession until the first frost cuts them down in late autumn or early winter. From then on many gardens look rather drab, especially in the colder parts of the country, but there are some perennial plants which either by their flowers or their foliage will enable the gardener to have some colour in the garden through the duller season.

Most of the subjects dealt with in this article are evergreen and some will flower to a limited extent in winter, though most of them flower more profusely during the warmer part of the year. A few of them are not quite hardy and can be grown only in favourable positions in the coldest districts, but most are hardy enough to stand up to the climate generally met with in this country.

In flower gardens perennial plants, whether herbaceous or evergreen, are generally used in mixed borders together with annuals and sometimes shrubs to give a continuous display. When they are grown in such mixed borders it is difficult to give each plant the required attention, especially the desired preparation of the soil before planting. This matter should not be overlooked. Once a small new plant

Left—*Chrysanthemum maximum* Esther Read is the most free flowering of the shasta daisies. Right—Heuchera used as an edging in front of a concrete wall.





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or cutting has been planted it is expected to develop into a fine plant, and it can be assisted to do this only by the addition of nutrients to the soil and by keeping the surface free of weeds and cultivated.

Before planting takes place the position should be dug deeply and old animal manure or compost should be incorporated in the soil. A dressing of 2oz. per square yard of superphosphate or 4oz. per square yard of bonedust will also assist the plants to establish.

Cuttings

Many perennial plants are raised from cuttings. For this purpose vigorous shoots should be selected either from near the bases of the plants or from short side shoots. They should be 2in. to 4in. long, depending on the general habit and size of the plant. The lower leaves should be removed and the bases of the cuttings trimmed across just below nodes with a sharp knife. They should then be inserted in sandy soil in a propagating frame. If a frame is not available, a few cuttings can be accommodated under a preserving jar. They should be well watered in and kept closed up for 10 days and shaded from direct sunlight. From then on ventilation should be gradually increased, and in a few weeks root growth will begin.

Treatment with one of the rooting hormones will assist growth, but the use of such hormones will not justify less care of the cuttings while they are forming roots.

Snails and Slugs

By their nature of growth all the plants described will provide an excellent habitat for snails and slugs, and new shoots may be considerably damaged by these pests. The best control is a bait of bran and metaldehyde. This is made by mixing 1oz. of metaldehyde powder with 2½lb. of bran moistened with molasses. Small heaps of this should be placed, preferably during the evening, near any suspected haunts of snails and slugs.

Gazanias are colourful when growing in full sun. [*Elliott*

The description and habit of a number of perennials which are easy to grow and the special requirements of each plant and the method by which it can most easily be propagated in the home garden are given as follows.

Left—A cutting of a perennial plant prepared for insertion. Right—A cutting of the same plant after it has rooted.

Sunny Positions

Gazania or black-eyed susan is an old favourite and a very useful plant. The flowers are daisy-like in various shades with darker centres and the foliage is dark green. They are very accommodating plants, but do best in a well-drained light soil. They will tolerate fairly dry conditions and are useful for seaside gardens, as they will not be affected by a salty atmosphere. They have to some extent a trailing habit, which also makes them suitable for planting on a hillside. A sunny position is essential for profuse flowering, and in warmer districts they will flower nearly all the year.

They are easily propagated by cuttings, the best time being either spring or autumn. Some varieties tend to become woody and should be renewed every few years.

Arctotis is more vigorous in growth than gazania, but otherwise their habits and requirements are much the same. The flowers are also much like gazanias, but the stalks are generally longer. Some varieties have silvery or grey foliage which looks most attractive. Arctotis is very tolerant of seaside conditions and is really useful in coastal gardens, where soil conditions are often poor. After a few years plants should be replaced by rooted cuttings taken from vigorous shoots. Cuttings root very easily and can be taken at any time of the year.

Aubrietia flowers for a long period during spring and summer in blue, purple, red, and pink shades. It is an evergreen which forms a close cover over the ground. A variety with variegated foliage is also obtainable. Because of its trailing habit it is very useful for planting on the tops of walls

Nepeta makes an attractive edging against a path.

and on banks, but its spread can be restricted by trimming the plants back when they are not in flower. Propagation is by division of old plants or by removal of small pieces with a few roots attached, and can be done in either autumn or spring.

Flowering is most profuse when the plants are in a position getting sunshine half the day, but aubrietia will grow in almost any position with good drainage.

Mesembryanthemum or ice plant will grow in a very dry position and does not require a good soil. It flowers only during summer, but the grey succulent foliage looks attractive all the year. Some varieties are vigorous trailers suitable for covering banks or walls and can also be used for training over old tree stumps. Other varieties form a compact clump and do not spread very much. Mesembryanthemum is obtainable in many bright colours but plants will flower well only if grown in a sunny position. Propagation is by cuttings and rooting takes place easily, and even leaves that fall off a plant may form roots and produce new plants.

A bright and novel display can be made with these plants by growing them on the trunk of a Canary Island palm (*Phoenix canariensis*). Small plants are easily established in a few handfuls of soil placed in one of the "pockets" created where the fronds of the palm have been cut off.

Verbena flowers for a very long time during summer and in milder districts some varieties may flower during winter. The different varieties provide a great colour range, and the size and habit of the plants vary. They should all be planted in sunny and well-drained positions in moderately fertile soil. Propagation is by seed in spring or autumn or by cuttings taken any time during the growing season.

Gaillardia has both annual and perennial varieties. The perennials flower for a long period. In milder districts they will produce a few flowers during winter, but in colder localities they will die down to the ground after frosts. They are available in many bright colours, mainly in golden, bronze, and red tonings. The flower stems are generally 9in. to 12in. long. A sunny position suits them best; they will tolerate shade, but growth will become rather straggly. The plants can be pruned back to keep them in check, and if winter flowering is desired, fairly severe summer pruning should be carried out.

Propagation can be carried out by seed in autumn or spring, but some variation will generally be found in the seedlings. To ensure that plants are true to the colour of the parent plants cuttings can be taken during spring or summer or plants can be divided during winter. If planted in a heavy soil or in a wet position, the plants tend to die out during winter.

Nepeta mussini or catmint forms a tufty growth of fine green foliage on wiry stems which carry mauve flowers. It is useful both for separate planting or for an edging to a border. Flowering begins in early summer and lasts a long time. In milder districts plants can be cut back after the main flowering has taken place and a second lot of growth and flowers will develop. This will generally keep the plants very attractive through winter. The plants should always be cut back to allow spring growth to break away from the bases.

Plants should not be allowed to become too old, and can be divided after a few years. Cuttings taken from side shoots during the growing season root readily. Catmint grows best in a sunny position.

Arabis is another plant giving close cover on the ground. It is suitable for growing in front of a border and will sprawl over rocks. The greyish green foliage makes the plants attractive all the year. Flowering takes place in early summer. Most varieties have white flowers on 6in. to 9in. stems, but pink ones are also obtainable. There is also a variegated form with green and cream leaves which gives a more colourful effect.

Arabis prefers a fairly sunny position; otherwise it is not particular in its requirements provided the soil is fairly well drained. New plants are obtained either by division of plants in autumn or by cuttings taken in summer.

Heuchera is a plant for the front of a border. It does not sprawl as some of those mentioned previously. The leaves form rosettes from which the flower stems grow to a height of 12in. to 18in. carrying small red flowers. Flowering takes place over a long period during early summer. A light soil and a fairly sunny position are preferable. Propagation is generally carried out by division in autumn.

Saxifraga umbrosa or London Pride is rather similar to heuchera but is more dainty in growth and has delicate pink flowers. Not being so robust in growth it requires a little more attention, but the plant is quite hardy and will tolerate a shady position. There is a variety with white variegation in the leaves.

Echeveria is a succulent plant which is quite useful. There are several varieties used in gardens, most of them being greyish green and having flower stems carrying coral shaded bell-like flowers in early summer. They are often planted as an edging for a flower bed and will then assist in keeping the bed tidy without taking much nourishment out of the soil to the detriment of other plants.

Propagation is usually done by taking off some of the small plants formed at the bases of established ones. Because of this habit of growth the plant is sometimes called "hen and chickens". If used for an edging, the plants should be replaced with offsets every 2 or 3 years, and this is best done in spring. In the coldest district echeverias may be killed by frost.

Alyssum saxatile is not very showy except in the flowering season, but as it commences flowering fairly early in spring, it is well worth considering. The plant is fairly small, but the flowers form a mass of golden yellow radiating from the plant for a distance of 12in. to 18in. The foliage is grey.

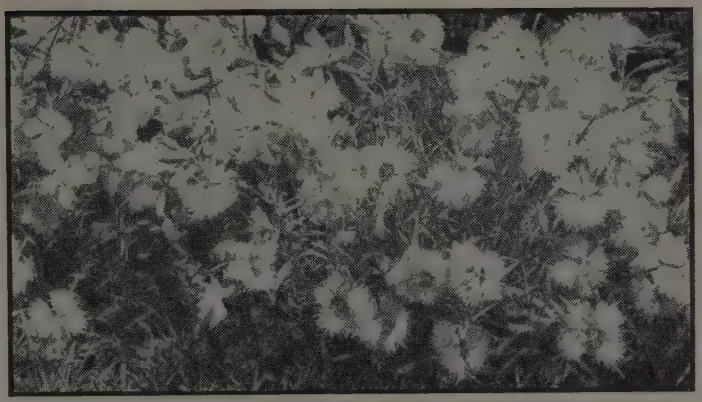
Alyssum saxatile is a sun-loving plant which will tolerate rather dry and poor soil conditions. Propagation is usually carried out by seed, which can be sown as soon as it is available after flowering.

Felicia amelloides, better known as *Agathaea caelestis* or blue daisy, is classified both as a sub-shrub and a perennial. It is a plant well worth considering for the mixed border in the warmer districts. If attempted in the coldest districts, it should be placed in a sheltered position.

The pale blue daisy flowers are carried in profusion all through the warmer part of the year, and in the most favourable localities plants will flower in winter also. The plant grows only about 18in. to 24in. high with a larger spread. It tends to become woody after some years and should then be renewed, as vigour is essential for flower production. It should be planted in a sunny, well-drained position, and a light soil is preferable. Cuttings root readily and can be taken from strong shoots during the growing season.

Chrysanthemum maximum var. Esther Read is the most popular of the shasta daisies. It has double white flowers on 9 to 18in. stems, which last for a long time both on the plants and if used as cut flowers. Though the greatest number of flowers are produced in early summer, plants will keep on flowering right through to the autumn, and in northern districts even in winter. The foliage, which is dark green, remains on the plant the whole year.

Shasta daisies should be given a fairly sunny position and a well-drained soil. They are vigorous and established plants provide an ample supply of rooted suckers. They should be broken up and replanted when the clumps become woody and bare of growth in the centre.



[*Elliott*

Dianthus provides many different types of plants for sunny positions.

Dianthus comprise both carnations and pinks and provide a great variety of plant material. The alpine section and the border carnations are the most pleasing when not flowering. They flower for a limited period only, but the grey foliage forms a tufted mat for the remainder of the year. Some perpetual flowering carnations tend to become rather leggy and untidy for garden display, but provide flowers over a much longer period.

All dianthus should be planted in well-drained open soil that is not acid; plenty of sunshine is also essential. Some will become rather woody after some years and should then be renewed. Propagation is best carried out by layering of the plants, which should be done during summer. The new plants will then be ready for planting out the following winter. To propagate pinks side shoots can be

Below—Campanulas are very useful perennials. Elliott photo.

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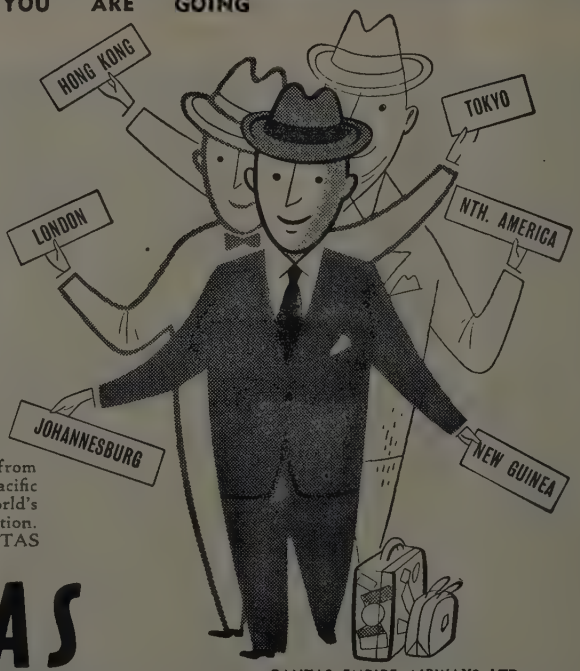

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pulled off with a portion of the old stem after flowering, and will root in garden soil if well watered.

Begonia semperflorens, the fibrous-rooted begonia which is used so much for bedding out, is a perennial. It will be cut to the ground by frost, but if protected during winter, it will break from the base in spring. During summer it will tolerate adverse growing conditions. Best results are obtained if planting is done in a fairly sunny position where the soil has been enriched with old manure or compost.

Commercial propagation is by seed, but begonia seed is so fine and growth so slow in the early stage that a glass-house is necessary for raising the seedlings. For the flower garden plants are best multiplied by division of old clumps in spring or by cuttings, which are best taken from the growth appearing at the base early in the growing season.

Shady or Moist Positions

Campanula or bellflower is available in many different varieties and types. The biennial, Canterbury bell, is the commonest species. Most campanulas carry flowers in blue shadings, some of which are very pale and some pure white; flowering takes place during summer. The smaller types have fresh-looking green leaves forming a tufty mat, which looks attractive throughout the year.

Most campanula do best in semi-shade, where they will get some sunshine. The soil should not be too heavy and should have a good humus content.

The perennial species are best propagated by division of old plants in early spring.

Saxifraga crassifolia is quite different from *S. umbrosa*. It has large leathery leaves, which are dark green if the plant is not growing in full sun; the leaves rise from a rhizomatous stem. The pink flowers are carried in dense panicles approximately a foot above the foliage during late spring. They will tolerate a fairly moist position and do best in semi-shade.

Propagation is generally carried out by division of the rhizomes in autumn.

Anemone japonica, botanically known as *A. hupehensis*, is a subject which will grow both in full sun and in semi-shade and which will tolerate fairly moist soil conditions. Varieties are available in shades of pink, red, lavender, and in white; there are semi-double and double types as well as the more common single flowered ones. Flowering takes place in late summer and autumn. The plants will then be about 3ft. high.

These anemones are all hardy. They sucker freely, in fact, care should be exercised to keep them under control if grown among other plants. They should be cut back when flowering has finished; new growth will soon develop and furnish a ground cover in positions where they are not cut back by frost.

Hellebore is a popular winter flowering perennial. [*Elliott*

Propagation is by division of established plants; the best time to do this is in autumn or early winter.

Helleborus, commonly known as hellebore or winter rose, will flower everywhere during winter. There are several varieties with flowers in white, green, and purple. They will tolerate a fairly sunny position, but do best in shade. Adequate moisture during summer is essential.

The position chosen for them should be well drained and the soil well enriched with leafmould or compost before planting. They should not be disturbed before they have crowded their position, as transplanting will interfere with the flowering ability. Old plants can be divided in spring or as soon as flowering has finished.

Seedlings will often be found near established clumps and can be transplanted; they will take several years to flower and if derived from a planting of mixed varieties, different colours may eventuate when they do come to the flowering stage.

Hosta, perhaps better known as funkia, is mainly grown for the decorative foliage, though the flowers are attractive. The large leaves give a good ground cover during summer; there are both green and variegated varieties. The flowers grow 1½ft. to 2½ft. high. Hosta will grow in semi-shade and prefers moist growing conditions. This plant is very vigorous and division can be carried out as often as desired. It is best to divide the plants during autumn or winter while they are dormant.

Hosta requires plenty of organic material in the soil and an annual dressing of old manure or compost should be applied.

Flower Garden in April

A cheap and easy way of raising plants is by cuttings. During late autumn and early winter many trees and shrubs, both evergreen and deciduous, can be raised from hardwood cuttings. Softwood and half-ripe cuttings are better taken during the warmer months. To be successful cuttings must be selected from the most suitable type of wood and must be taken at the correct time. This is largely a matter of experience, but in general hardwood cuttings should be made from well-ripened, healthy wood of the current season's growth. With deciduous trees and shrubs this is not difficult to select, as the wood is usually suitable as soon

[*Campbell*

Typical hardwood cuttings of deciduous flowering shrubs and evergreen hedge plants. At left and right are flowering currant and forsythia, both deciduous, and in the middle is escallonia, a most useful evergreen hedge plant.

as the leaves have fallen. These cuttings are best made about 8in. long. The base of the cutting should be cut square about ⅛in. below a node and the top should be cut at a slope about ⅛in. above a node. If the basal cut is made in this way, rooting is better, and an indication is also given of which is the bottom when the cutting is being planted, as with some cuttings it is difficult to distinguish the tops from the bottoms.

With evergreen trees it is more difficult to tell the exact state of maturity, but suitable wood for making hardwood cuttings is that which is not still actively making new growth. Cuttings are made in a similar way to those of deciduous plants except that the leaves on the portion which will be below ground when planted should be cut off with a sharp knife. Many common hedging plants such as escallonia, *Lonicera nitida*, and abelia can be rooted in this way.

As soon as the cuttings are prepared they should be planted and not left to dry out. The plot should be well prepared beforehand. Cuttings of decidous trees and shrubs can be planted in any well-drained position, but evergreen cuttings are better if they are given some protection from strong winds and severe frosts. The cutting must be planted firmly to about half to two-thirds of its length. If it can be pulled out with a gentle tug, it has not been planted firmly enough. Deciduous shrubs which can be raised easily from hardwood cuttings are deutzia, weigelia, forsythia, philadelphus, and tamarix.

Perennials

Where planting of perennials has been left it may be completed now. Rudbeckia, michaelmas daisy, and golden rod will all break up and provide new plants if required. Kniphofia (red hot poker) is obtainable in many colours and varying sizes. It is a most useful standby in the garden, and new plants can be obtained by pulling off a vigorous side shoot with some root attached and planting it. When perennials, or any flowers for that matter, are being grown colours which suit the indoor colour scheme should be selected so that they will be useful for cutting for arrangements.

Lily of the valley beds which have become root bound can be lifted, divided, and replanted as soon as the foliage yellows. Well-decayed compost or farmyard manure can be dug into the soil before replanting.

Any annuals which have finished flowering and look untidy should be pulled out and put on the compost heap if they are disease free. Any tidying up which can be done should be carried out as the opportunity arises.

Bulbs

All bulb planting should be completed now. Narcissi, tulips, and spring flowering bulbs should be in before the ground becomes too wet to work, and unless they have a reasonable period in the soil before flowering, good results cannot be expected.

Ordering Plants

April is the time to consider improvements and new developments to be carried out and, most important of all, to decide on new plants to be ordered for planting in June. Early orders mean a better chance of getting the plants required. Orders are dealt with in rotation and in some lines demand may exceed supply, so it is wise to order early.

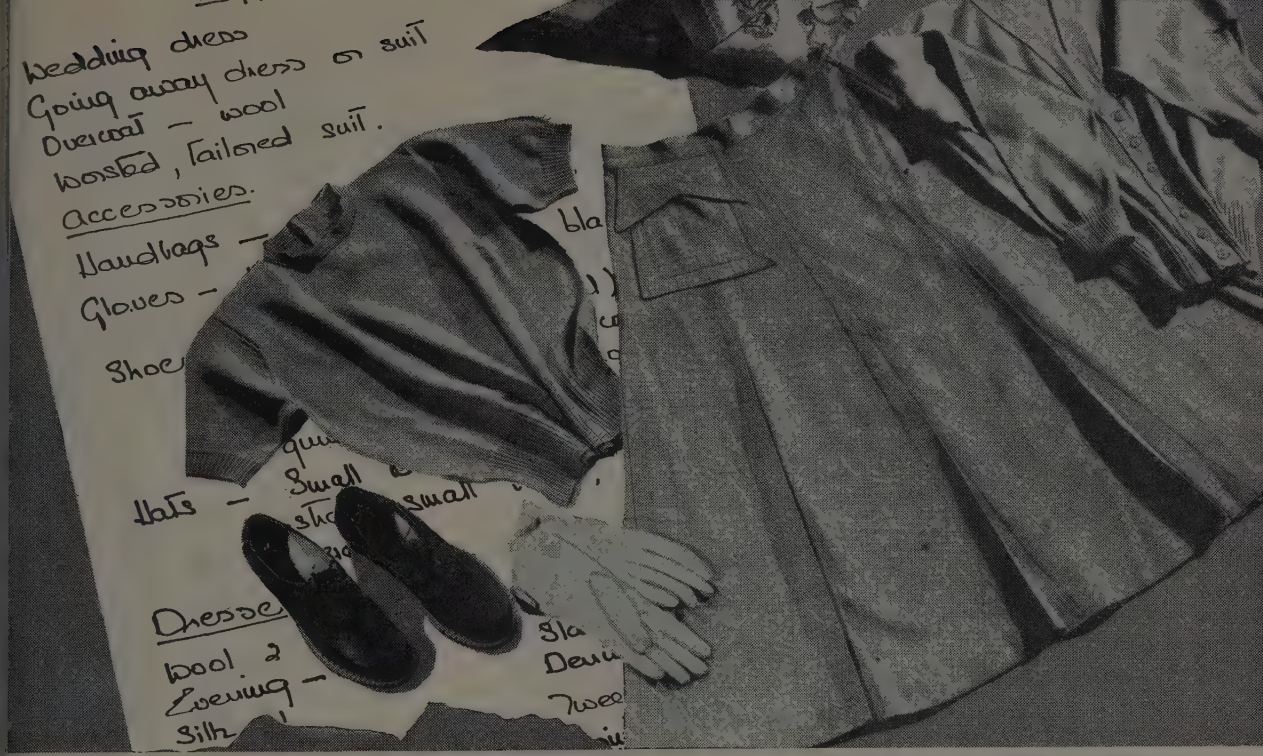
Garden Maintenance

Drives and paths needing attention should be reshingled and the gutters cleared of weeds and leaves ready for winter. Badly drained areas may need tile or fascine drains, and well-worn routes which soften up in winter may need a shovel or two of gravel to keep them dry. Where shrubs and plants grow across the drive they should be cut back so that there is no chance of brushing past them and getting showered with water on a wet day. Shrubs should be set well back from a path, as a path is only as useful as its narrowest point and it spoils the look of shrubs if they have to be kept straight on one side to leave the path clear. However, for winter particularly the path should be kept as clear of spreading branches as is practicable.

Bonfires are a good way of getting rid of rubbish, but fires should not be lit under trees or too close to hedges, even on a calm day, as the heat has a harmful effect on foliage and can cause whole branches to die. The ash from bonfires can be used on the garden, but it is of little value unless it is used before rain leaches out the potash and other minerals. Too thick dressings have a deleterious effect on soil structure.

Lawns

Sowing down of lawns may be continued, and established lawns which have become sparse may be raked over and oversown with a grass seed mixture. Any hollows in the lawn may be filled in with soil, levelled, and sown. Details of lawn sowing were given in last month's routine flower garden notes.



Choosing a Trousseau

Useful country clothes are a twin set of pale, dusky green wool and a skirt of fine worsted checked in fawn, brown, and matching green. With these are worn sturdy, comfortable brown brogues, washable white hog-skin gloves, and a scarf of fine natural coloured wool gaily patterned in amber, yellow, white, and green.

CHOOSING a trousseau and planning an everyday wardrobe are essentially much the same thing. The bride may be changing her way of life and perhaps going to live in a different district, but basically the factors which govern the choice of clothes will be the same for her as for her sister who is planning to change or add to her wardrobe. Today's trousseau is small compared with that of past centuries, but it is just as important to the modern bride-to-be as it was to her great-great-grandmother. Living conditions and fashions have been constantly changing, and gradually the big trousseau, carefully sewn by hand, has given way to the smaller, more practical, often machine made wardrobe of today. Choosing a trousseau and perhaps making many of the garments is one of the most pleasant and exciting steps in preparing for a wedding, and here Betty M. Johnston, Field Officer in Rural Sociology, Department of Agriculture, Wellington, suggests some of the factors to be considered when planning a trousseau or an everyday wardrobe.

IN the past every young girl who hoped one day to marry spent many hours stitching beautifully embroidered underclothes and linen, which were carefully put away amid layers of tissue paper or wrappings. These one day would be part of her dowry, for it was unthinkable that any girl should come to her marriage empty handed. Often, if her father was wealthy, land and valuable possessions also formed a part of her dowry. This portion would be controlled by her husband, as married women then had no legal rights in the management of their own private fortunes.

Now the picture is different. An Act of Parliament, the Married Women's Property Act, has given married women in this country the legal right to control and use their own property as they think fit. With increasing numbers of women earning their own livings in professions and industry, the old idea of marriage settlements has gradually died out. Now many young women prefer to work or train for some profession or trade for a few years before undertaking married life, and by careful saving have a nest egg put aside for buying their trousseaux.

Though the old conventional ideas about marriage preparations have changed with the years, a trousseau still remains a very important item in any bridal plans. Choosing and often making many of the garments herself, the bride of today probably has much the same thoughts and dreams as her great-great-grandmother had, though she will probably be sewing nylon or rayon on an electric sewing machine instead of painstakingly embroidering and tucking fine lawn or pure silk. Machine made lace has replaced hand-worked ruffles and flounces, and gossamer fine woollens, both knitted and woven, are a far cry from flannel, winter petticoats and heavy, knitted stockings.

Trousseau in its widest sense means both household linen and personal clothing, but an article in the "Journal" for December 1954 discussed the buying of linen, so this article will cover the planning and choice of a wardrobe for a bride who is to live in the country.

Budgeting

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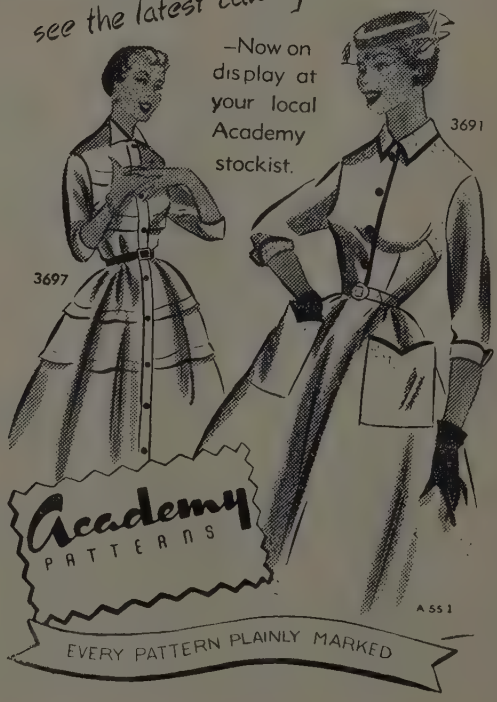


to relative values, resulting in selection of clothing better adapted to individual needs. Thus the trousseau or wardrobe will be chosen more carefully and the pitfall of being tempted to buy unnecessary things and to leave out essentials will be avoided. A shopping plan will save time, money, and energy, because the exact amount to be spent on each item is known. Such a plan is called a budget.

Personal preference and needs, naturally, will modify any suggested general plan for a bridal wardrobe, but the basic principles of all budgets will be the same.

The money available for a trousseau depends on how much assistance the girl's family can afford to give her, and, often, on how much she has managed to save herself. The way in which the money is spent depends on several factors, a fairly important one being the standard of living. This is usually acquired unconsciously from home surroundings, and it is quite natural to try to maintain this way of life regardless of the ups and downs enforced by changing social and economic conditions. Most people feel happy if they dress in a style more or less the same as that of others in their own social group, and nothing is more uncomfortable than to feel the odd man out because of unsuitable dress.

Another factor influencing the expenditure of money is the social position of the bride, because her choice of clothes will depend on the life she is to lead. For some, three or four outfits for formal occasions will be necessary, but others will be able to keep this item to a minimum. The country bride will need a different kind of wardrobe from the one that would be chosen by a bride who is to live in town.

Life in the country may in some respects seem quieter than that in town, but country people are most hospitable and dances and parties are not rare events. The bride unused to country ways may be surprised by the amount of entertaining and entertainment in her district. Dances and socials, visits to neighbours for meals and to the local weekly picture show, and occasional games of tennis or golf are all probable. The newly married woman will find that she has a house and perhaps a garden to set in order, but she will find some time for relaxation and exchanging visits with her neighbours. The country bride should bear in mind the kind of life she will be living when she plans her trousseau.

A girl who can sew will plan to spend her money differently from one who must have her clothes made or buy them ready made. Also, if she sews well, she will save money. Handmade underclothes in silky rayons, nylons, and pure silks are a seeming luxury which are within the reach of any girl who sews moderately well and who has the time to spare. For the indifferent sewer and for the girl who is very busy working or helping at home there may be little or no time for dressmaking and clothes will have to be bought or be made by a dressmaker.

A warm, loose-fitting overcoat which can be worn over dresses or a suit is a necessity in any country wardrobe.

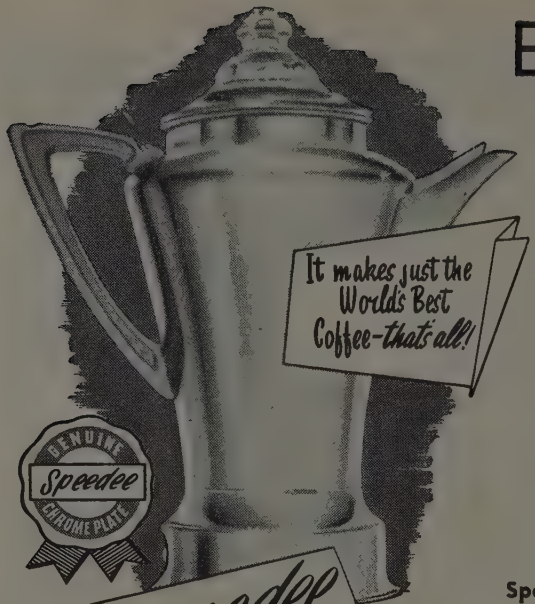
Wedding Dress

The first essential on the list is a wedding dress. This may be the conventional long white dress worn with an accompanying tulle or lace veil, which is very often borrowed from a friend or is used in turn by all the girls of a family. For small weddings the shorter, ballerina length dress has become popular, and has the advantage that it can be used again for small, informal dances and parties, as it need not be white. Pastel colours, silver, and silver-grey brocades are all suitable for a short wedding dress. The veil should be shorter than for a long dress and fairly simple, as an ornate one gives a topheavy appearance.

When the wedding is small the bride may feel that the expense of an elaborate and not often worn frock is not justified, and she may prefer to wear an afternoon dress or a suit. These should be well cut and made and should fit perfectly. It is better to wear simple, well-fitting clothes than to attempt to dress up in flounces and flowers that suit very few women, romantic fashion papers notwithstanding. Fussy clothes have no place in country life, where the accent is on practicability. A clean, simple, uncluttered line will not date rapidly and it suits most figures. This can be a money saver for the girl who will have large initial expenses in her home and who would begrudge money spent on early wardrobe replacements.

Accessories and Overcoat

When the problems of wedding and going away dresses have been settled the next important items are accessories and an overcoat. These and a suit are the basis of a wardrobe and all other outfits should be planned around them. For the wedding dress a veil, white or silver shoes, light coloured stockings, and white underclothes are probably listed, and the travelling dress or suit needs shoes and a matching handbag, and gloves, stockings, underclothes, an overcoat, and a hat. It is a good idea to choose two or three basic colours for shoes, handbags, and gloves; for example, brown for day wear, black for evening, and,



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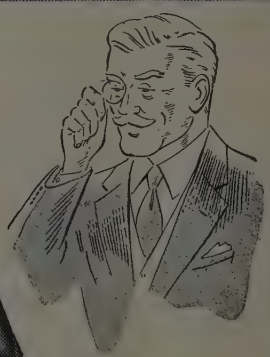

FROM ALL LEADING SHOE STORES

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possibly, white for the summer. Coloured shoes and gloves can be added if the budget permits, but it must be remembered that such things as gumboots, a strong raincoat, and low-heeled shoes are absolute necessities for country living, as are two or three cheap, cotton print dresses or an old skirt and jersey for wearing while doing household chores. Aprons should not be forgotten, either. It is better to budget for essentials first, and then buy extras and luxuries.

A good overcoat is necessary in the country, where long distances are often travelled in very bad weather. This will not be an inexpensive item, so it should be chosen carefully. A bright, unusual tweed may be most attractive, but it will be difficult to choose a wardrobe to harmonise with it, and also it will become very well known and will date rapidly. It is not necessary to be drab or dull, but instead a happy compromise can be made between startling originality and plain, ordinary dullness. A loose-swinging, well-cut coat of medium-weight tweed which can be worn over a suit, dress, or skirt and jersey and which has several muted colours subtly woven into its cloth would be both useful and attractive. For a girl who plans to have a family fairly soon this type of coat is very useful, being both practical and fashionable. For summer a lightweight rayon, shantung, or dupion duster coat is a good choice. If the colour is neutral, for example grey or charcoal, the coat can be worn with any lightweight dress, silk or cotton, and will look right at night, too.

Wide Choice of Suits

Many good suits are being made by manufacturers, and for those who are lucky enough to be stock size the choice of material, colour, and style is wide. A conservative cut is probably the best style for the girl who will not be able to have more than one coat and skirt at a time. A suit, too, is not a small item in the budget and care is needed in its selection. It should match or harmonise with the overcoat and it should be well made, with a good lining and finishings. Skimped skirts are uncomfortable to wear, so it is important to be certain that there is room to walk and sit without undue strain on the seams. A pleated skirt does not have the same tendency to "seat" as does a straight one, and it is more becoming to the average New Zealand figure. Straight, pencil slim skirts suit very slim, tall women, but not their tubbier sisters. A made to measure, tailored coat and skirt may seem a luxury, but if the material is good and the cut and workmanship are sound, it should last for years and be a joy to possess.

Blouses, jumpers, scarves, and twin sets to wear with a suit and with an odd skirt are needed, but the number and colours will vary according to the size of the budget and the taste of the wearer.

Hats, too, are very much a matter of individual choice. The ubiquitous beret, pulled to either side, has proved to be so useful and inexpensive that it has a place in any wardrobe.

Various Dresses

Dresses for summer or winter are basically much the same in design and type of fabric. For daytime plain and tailored lines are most suitable, with fuller skirted, more elaborately designed dresses for the evening. Day fabrics are plainer than those worn in the evening, as they are usually given harder wear and need more frequent cleaning or laundering. For winter or summer the shirtwaist style is always popular and may be worn for many different occasions. Plain wool cloth or wool jersey is a good choice for winter dresses, and for summer linen a good-quality cotton or a linen type rayon will wear and wash very well. Crepe fabrics look well, but they do not wash satisfactorily, requiring frequent cleaning. A figured silk dress is suitable for more formal occasions and a ballet length dress of faille, taffeta, lace, or a fine, silky cotton is a useful addition to the trousseau wardrobe.

It is important to remember to choose styles which are not only suitable for the occasions when the dresses will be worn, but which also suit the wearer. Unflattering fashion lines should be ignored or modified to suit individual taste, for above all it is important to feel happy and "at home" in a dress. It is equally important, of course, not to look odd or eccentric.

This pinkish, putty coloured suit with a black velvet collar can be worn with different accessories. The model is wearing a white fur felt hat, black and white string and leather gloves, and a brightly coloured silk scarf. Her black calf handbag is a useful size for travelling. The same suit worn with a small black hat and without the scarf would be suitable for formal occasions.

This ready-made dress of fine, silky peacock blue cotton with an all-over design of tiny, yellow-centred daisies can be worn on many occasions—for shopping in town, at home, or for informal summer parties. Here it is worn with a white hat, gloves, a handbag, and black shoes. A small black hat and a black handbag could be substituted for these white accessories to vary the theme.

Shoes

Shoes have been mentioned under accessories, but one or two points are worth noticing. Flat-heeled shoes are more comfortable to walk in than are high-heeled ones, and a day in town or at the A. and P. show can be a day of acute discomfort if feet are sore and tired. A pair of shoes with medium heels is a very good investment, especially if they have been fitted correctly in the shop. It is worth spending extra money to get comfortable as well as good-looking shoes. The larger-skirted dresses worn at night need lightweight, dressy shoes, and here high heels are in order, but only if the wearer is comfortable in them: Laced-up brogues are the best shoes for outdoor wear on the farm or for walking or golf.

Underclothes

Underclothes have been left to the end of the list, as most girls know their own special requirements. For the wedding dress a long petticoat with matching panties of the same material will be an obvious choice, and for the girl who likes sewing two or three sets of handmade undies will be part of her trousseau. Nylon, rayon, pure silk, and fine cotton in many colours and guises are available. Some people prefer to use bought patterns and others find no difficulty in designing and draughting their own. A nightdress is probably the easiest type of garment to make without a pattern, but petticoats are comparatively simple to design.

At least two or three sets of fine underclothes should be included in the trousseau, with two or three sets of warmer ones for wintery weather. Knitted rayon or nylon will be found practical for everyday use and can be chosen from many very pretty styles and pastel colours.

The bad old days of tight lacing to produce a fashionable, wasp waist have fortunately gone, and comfort and common sense dictate a more normal figure line. There is, however, no need to be resigned to having a bad figure. A sensible diet and a properly made and carefully fitted corset and brassiere can do wonders for a poor figure. It would be foolish to pay a great deal of attention to the design and fit of the outer garments when the underneath foundations leave much to be desired.

Stockings

Stockings should be chosen to harmonise with the colours of the shoes with which they will be worn, and it is a good plan to buy two pairs of each colour. If a stocking in each pair is eventually discarded because of ladders or holes, there will still be one remaining pair.

Dressing-gowns and Bed-jackets

A warm winter dressing-gown can be made (or bought) in a woollen cloth or corduroy velvet. Padded, quilted satin or glazed chintz is available by the yard and may be bought made into very pretty dressing-gowns and bed-jackets. Napped wool is warm and long lasting and is probably the best choice. A dressing-gown of lighter weight is useful for the hot, summer months and it is easier to pack, taking up less room in a suitcase than a thick bulky one a good point to remember when packing to go away for a honeymoon.

Bed-jackets are useful in hotels, and they may be made of quilted satin or glazed chintz or be knitted in fine, pastel coloured wool. Two of these should be sufficient.

Clothes for sports such as tennis, swimming, riding, and golf may be included on the trousseau list, and a pair of warm slacks for winter and stout cotton overalls for summer would prove useful for the girl who likes outdoor life or who is in charge of a garden and fowls.

Many other items may be added to the trousseau list such as padded and covered coat-hangers, handkerchiefs, extra underclothing and more dresses, and suits, but it is always wise to budget spending so that the essential things are bought first, extras and luxuries being added later if money permits.

Easy-to-operate Kitchen Bins with Good Utilisation of Space

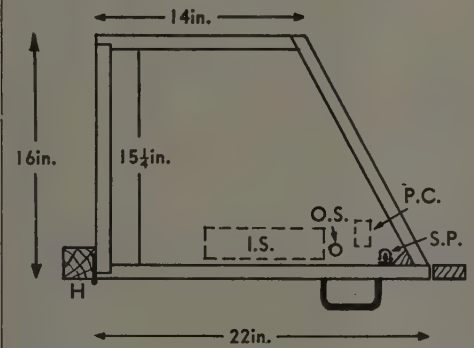
By EVELYN E. MOORE, Field Officer in Rural Sociology, and L. H. JOHNSON, Apiary Instructor, both of the Department of Agriculture, Palmerston North

BINS for the storage of flour, sugar, bread, and other foods are a popular choice with many housewives. Certain disadvantages are, however, apt to be encountered with conventional types. When full they may be difficult to open or they may require to be shut very carefully and gently to prevent them banging and spilling, especially if a bin contains flour. There is also the possibility that young children may catch their fingers when shutting them. Hinges on certain types tend to break away after a time and the stopper which holds the bin open may also be accidentally snapped off, allowing the bin to fall right out. Cleaning behind them may be difficult, too, and there is quite a considerable amount of waste space when bins are constructed by one of the conventional methods. The bins shown in the illustrations and for which working drawings are given are, however, constructed to obviate these problems.

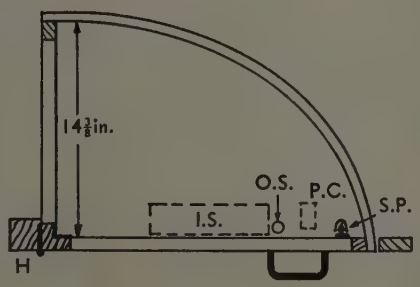
Bin built to No. 1 design.

AS is shown in the diagrams, the bins, which can be built in two different ways, are hinged and open in the same way as a door, with a free running plate castor on the bottom to take the weight and ensure easy opening and shutting. When bins are closed the top of each fits close under a shelf, leaving the unavoidable waste space on one side only. When they are fully open they not only allow the maximum accessibility but are easy to clean behind. Stoppers to prevent them from opening too far are also built in, and because of the method of construction these have very little strain on them and, therefore, would not break as stoppers on conventional bins tend to do.

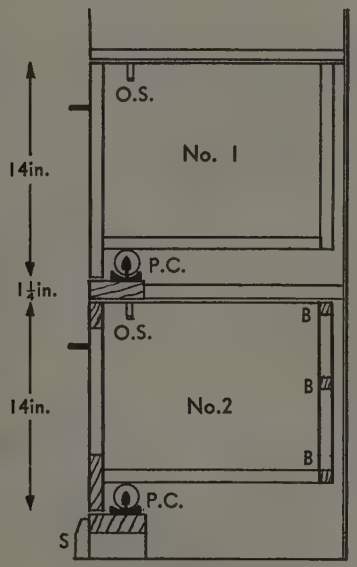
The bins, with measurements as shown in the diagrams, will easily hold a 70lb. bag of sugar or a 50lb. bag of flour.



PLAN OF NO. 1 BIN

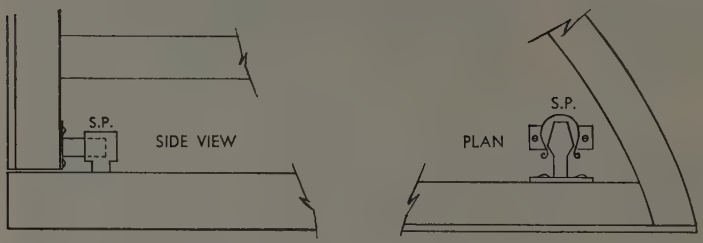


PLAN OF NO. 2 BIN



SIDE SECTION

I.S.—Inward stop. O.S.—Outward stop. P.C.—Plate castor. S.P.—Spring catch. B—Bands of plywood. H—3½in. butt hinges. S—Skirting. (The side section of two bins shows one of each design, though in practice one design would be used.)



Details of spring catch (S.P.) under bin.

The size could, of course, be scaled either up or down if required to fit into a certain area.

Working drawings are shown on this and the previous pages. The method of construction is as follows:—

Method of Construction

No. 1 bin is made from ⅞in. *Pinus radiata* boards glued together to obtain the necessary widths. The base is made first and the sides are built around it. All joints are glued and well nailed. If it is proposed to make a bin of a different width from that specified, it will be necessary to ascertain that the diagonal measurement from the hinge does not exceed the width of the front. A triangular length of wood is glued on the inside of the front oblique corner.

No. 2 bin has a base of ⅞in. thick timber, but the sides are framed and covered inside and out with plywood. The curved side is made by bending a piece of plywood (with the two wood grains vertical) around the base and then fixing it to the bottom and sides.

Three bands, each made of three thicknesses of plywood, are placed around the top, middle, and bottom respectively of the piece of plywood already attached. These bands form a strengthening framework, and an outer piece of plywood is placed over them to complete the curved side of the bin.

Each bin is hung by a pair of 3½in. butt hinges fixed to a 2in. x 2in. upright. Though the hinges are strong enough to carry the weight of the full bin, the provision of a plate castor fixed in an inverted position as shown in the diagrams will prevent any possibility of the bin sagging through use.

No. 2 bin involves more labour to make, but has a much better appearance than No. 1.

A Small Scoop for Fruit and Vegetables

THIS inexpensive, double-headed scoop is 7in. to 8in. long and is made of polished, stainless metal with an enamelled wooden handle. It can be used to make small balls of vegetable or fruit which give a festive air to simple salads or ice-cream.

The illustration shows the smaller scoop being used to make balls of iced watermelon for decorating plain ice-cream. Any fruit may be used to make iced fruit balls, which are pierced with a toothpick and served on a bed of crushed ice. Pears, apples, and peaches, which will turn brown when cut and left exposed to the air, should be first cooked in syrup and allowed to cool before fruit balls are made.

Balls may be scooped out of raw vegetables and used in casseroles and soups, but for serving with salads, balls cut from cooked vegetables are best.

—BETTY M. JOHNSTON, Field Officer in Rural Sociology, Department of Agriculture, Wellington

Ironing Synthetic Fabrics

COTTON and linen fabrics absorb considerable moisture and must be ironed until they are completely dry, necessitating a high temperature, firm pressure, and a steady back and forth motion. With synthetic fabrics, however, moisture does not readily enter into the substance of the fibres; the surface is wet but the moisture does not penetrate to the extent that it does in linen and cotton. These newer fabrics are ironed to smooth out creases, not to dry the fabric completely; they need only a moderate temperature, no pressure beyond the weight of the iron, and a slow, deliberate motion. They should be ironed on the wrong side, seams and darts pressed smooth, and gathers ironed into sufficiently to smooth them. Pockets, collars, and other details may have a final press on the right side with a dry pressing cloth (about the weight of muslin) to protect the surface of the fabric from glaze and shine.

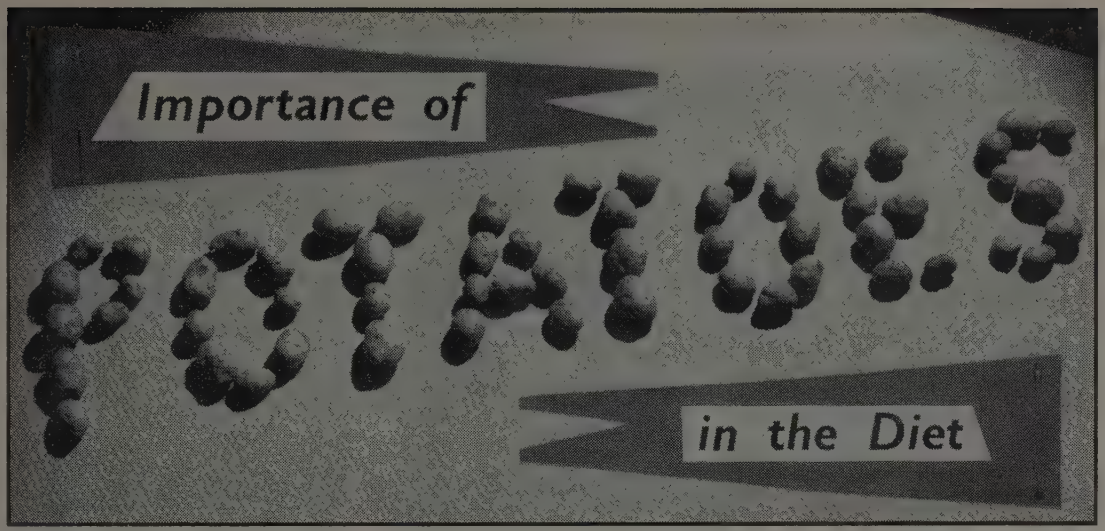
Drying before Ironing

Acetate is most satisfactorily ironed if it is first partly dried by being wrapped in a towel and left to stand for a few hours. It should then be ironed with a warm iron while still moderately damp and should be placed on a hanger or over a rail to air.

Nylon can be hung out to drip dry. It should be ironed with a warm iron and light pressure when almost completely dry. An iron that is too hot for the fabric yet not hot enough to melt it may damage white nylon by yellowing it.

Terylene can also be hung out to drip dry, and should be ironed either dry or slightly but evenly damp with a warm iron over a lightweight pressing cloth.

—MAUD B. STRAIN, Field Officer in Rural Sociology, Department of Agriculture, Dunedin



IN 1781, long before the food factors known today as vitamins had been isolated and identified, it had been found, chiefly from experience gained in long sea voyages, that the presence or absence of certain items in the diet meant the difference between health and disease for a ship's crew. In that year Sir Gilbert Blane in his work "Diseases of the Fleet" alluded to the beneficial action of the potato in scurvy, and later inquiries into the diseases of prisoners revealed that wherever potatoes were used scurvy was unknown. In this article Maud B. Strain, Field Officer in Rural Sociology, Department of Agriculture, Dunedin, stresses the important part played by potatoes in the diet.

SINCE the introduction of the potato into Europe there has been much speculation about its country of origin. This is now generally recognised as South America, but opinions are very divided when an endeavour is made to narrow this wide region to the specific locality. Similarly there is doubt about the potato's introduction into Europe. It seems fairly certain that the first introduction was from Peru to Spain about 1570, and the second was about 1586, when some tubers were brought to England from an unknown source. It is not known from which of these introductions the potato became established in the British Isles.

It was not until two centuries after it was discovered that it came into general cultivation, chiefly because of deep-seated prejudices against new articles of diet, but also partly because of the early methods of preparation (such as roasting and steeping in wine). In the last 150 years it has achieved extraordinarily wide use and popularity as a vegetable.

It is difficult to overestimate the importance of the potato, especially in Europe, where it has played a prominent part in the improvement of agricultural conditions and has prevented the recurrence of the periodic famines of former ages. A lamentable exception was the blight destruction in Ireland in 1846-47 and the resultant famine, which devastated the country.

Germany was for many years the greatest potato growing country in the world, but a considerable percentage of the harvest has always been devoted to the production of starch for industrial purposes.

Though potatoes hold an important place in the food supply of modern nations, they are not a satisfactory diet by themselves, on account of their large proportion of starch. However, it is a curious fact that in those countries where potatoes have been made the chief staple this unbalance has always been corrected: The Irish consume large quantities of milk and the Scots and Germans cheese and allied products. In England in normal times and in the United States of America the comparatively large amount of meat eaten has supplied most of the protein required.

There has always been argument as to the relative merits of the mealy as opposed to the waxy potato. The mealy varieties are generally preferred for boiling or baking as part of the accompaniment for the meat course, but for salads and garnishes the waxy varieties are better both in texture and flavour. New potatoes are more waxy due to the higher proportion (in the young potato) of proteins, sugars, and flavourings compared with the very high percentage of starch in the mature potato.

In Paris and other parts of Northern France fried potatoes (the original French fried potatoes), are cooked and sold by street venders. Saratoga chips (the name is attributed to their first being introduced at Morris Lake, Saratoga, New York) are readily available in shops throughout New Zealand.

Greening of Potatoes

Potatoes which have been exposed to light develop a green colour which is frequently associated with the presence of increased proportions of an alkaloid substance called solanin. There is no real evidence that solanin is ever present in potatoes in harmful quantities and in any case the alkaloid is probably removed in cooking. However, the flavour of the greened portions is affected detrimentally, and for this reason it is best to remove such portions before cooking.

Storage

Potatoes may be stored for varying periods without serious injury to quality. To keep them in good condition it is essential that they be stored in a dark, cool, well-ventilated place. Excessive dampness should be avoided, but extreme dryness is also bad, because it tends to shrivel them. If they appear to be shrivelling, they can be packed and covered with sand, which can be dampened occasionally. A temperature a few degrees above freezing (about 42 to 45 degrees F.) is preferred, because when the potatoes are stored at a low temperature, the increase in sugar content is so great that the potato may taste sweet. The increase in sugar content also affects the suitability of the potato for making Saratoga chips or French fried potatoes, because the sugar caramelises and gives an undesirable brown colour. The high sugar content diminishes if they are left in a warm room for a few days.

Composition of a Potato

If a new potato is cut across with a sharp knife and the cut surface examined, three distinct layers can easily be seen. These are: First, the thin outer skin; second, a broader layer inside the skin, called the cortex or cortical layer (it contains a small amount of pigment and turns green when exposed to the light, giving the potato an unpleasant taste); third, the medulla or pith of the potato, which

makes up the rest of its bulk. On more careful inspection this is seen to be divided into a central core and a surrounding outer zone (see illustration below).

The cortical layer is richer in mineral matter and protein than the flesh, and if too thick a peel is taken off the potato, these valuable ingredients are lost. The flesh of the potato is made up of a solid part, mainly starch, and a juice which consists of water holding in solution proteins and other nitrogenous matter and salts. The richer a potato is in protein the more waxy it will be when cooked, because protein, for example, the white of an egg, coagulates or becomes firm when cooked. This is why young potatoes, which contain much juice, have a more solid and waxy consistency when cooked than older, more starchy ones. The richness of the potato in starch is its most striking chemical characteristic and causes it to be one of the chief commercial sources of that substance.

Preparation for Cooking

Potatoes should not be peeled, cut up, and left soaking in water for some time before cooking, because the soluble constituents dissolve out into the water. If the potatoes have to be peeled, this should be done immediately before cooking. Cooking them in their jackets is the best way, as thus there is no waste, the starch is thoroughly cooked and floury, there is no loss of minerals, and the skin can be removed without waste after they are cooked. Very old potatoes may have to be peeled, because the skins may have developed a bitter flavour. They should be peeled immediately before cooking, and steaming is preferable to boiling for peeled potatoes.

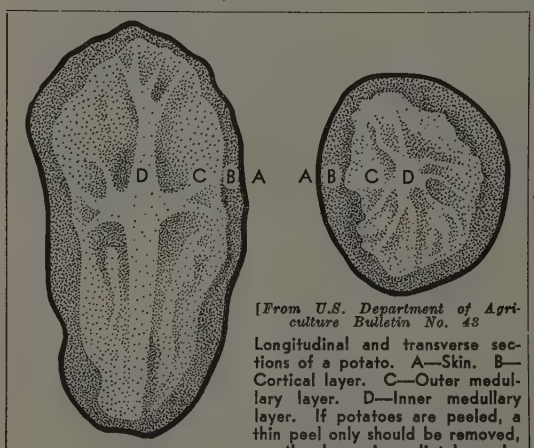
Reports suggest that a better texture and flavour will be noticed if salt is added at the beginning or mid-point of the cooking period; that there is less loss of nutrients if the vegetable is put into boiling water instead of being started off in cold water; and that the less water is used for cooking the less will be the loss and the easier it will be to use up all the cooking water. Another reason for not peeling potatoes is that unless a very thin peel is taken off, a considerable percentage of the flesh immediately below the skin is cut away with the skin, and this part contains a higher percentage of mineral matter, soluble carbohydrates, and soluble nitrogenous matter other than protein than does the remainder of the potato. For this reason also the smooth, well-shaped potato is more economical than the irregularly formed one with deep eyes. Potatoes should be washed and cleaned with a vegetable brush to remove dirt from the eyes and rough places in the skin, and any damaged parts should be removed.

Food Value

The potato ranks highly as a source of energy in the world's diets. It contains about 75 per cent. of water, 20 per cent. of carbohydrate, 2.5 per cent. of protein, and 1 per cent. of ash. Potato protein is of high nutritive value and both it and the starch are well utilised by the body. Potatoes should be well cooked for their starch to be most effectively utilised.

Potatoes are probably the most reliable source of vitamin C in the average New Zealand diet, because quite large amounts of them are eaten and they are eaten every day. New potatoes are richer in vitamin C than old potatoes; an average serving of new potatoes will provide about half the day's requirements. In common with other root vegetables potatoes retain a fair percentage of their original vitamin C content even after long periods of storage. The method of cooking has an important bearing on the amount of vitamin C remaining in the food when eaten. The following table shows the estimated loss due to the different methods of cooking:—

	Average loss of vitamin C per cent.
Boiled in their skins	15
Baked in their skins	20
Fried in their skins	30
Boiled after being peeled ..	50



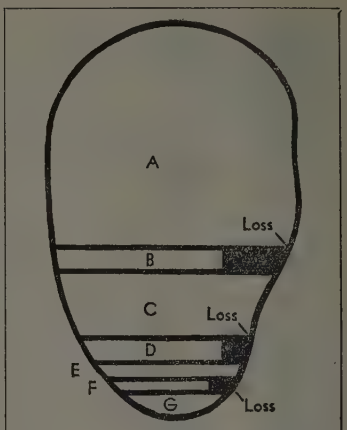
[*From U.S. Department of Agriculture Bulletin No. 48*

Longitudinal and transverse sections of a potato. A—Skin. B—Cortical layer. C—Outer medullary layer. D—Inner medullary layer. If potatoes are peeled, a thin peel only should be removed, as the layer immediately under the skin is richest in protein and mineral matter.

Potatoes are also fair sources of other vitamins, energy, and iron, for though the percentage of iron is low compared with that in many other vegetables, it is in such a form that it is completely utilised. This, and the fact that relatively large amounts of potatoes are consumed makes them an important source of iron in many diets.

Reducing Diets

From the above it will be realised why overweight people trying to reduce their weight should not omit potatoes from their diet. There are many less nutritious foods with a higher energy value which could with benefit be excluded instead. One moderately thick slice of bread (about 2oz.) and butter provide about 4½ times as many units of energy as a potato of equivalent weight. To conserve their vitamin C content potatoes should not be overcooked and should be served immediately they are cooked. If delay is unavoidable, it is better to cool the potatoes and reheat them quickly when needed; this is less wasteful of nutrients than keeping them hot. Hot cooked potatoes exposed to the air lose vitamin C, and mashed potatoes especially should always be served as soon as they are prepared. Experiments with baked potatoes have shown that on completion of cooking 88 per cent. of the vitamin C was retained, but when the potatoes had been left standing for 11 minutes this had dropped to 74 per cent. and after 26 minutes was down to 61 per cent. Mashed potato loses its vitamin C particularly quickly.



Percentage composition of a potato, showing the great loss of valuable food constituents when the potato is peeled before it is cooked. A—Water, 78.3 per cent. B—Protein, 2.2 per cent. (loss, 25 per cent.). C—Starch, 18 per cent. D—Extract, 1.4 per cent. (loss, 26.8 per cent.). E—Fibre, 0.4 per cent. F—Mineral matter, 0.1 per cent. (loss, 38 per cent.). G—Fat, 0.1 per cent.

Variety in Methods of Cooking

Potatoes can be served in a variety of ways, even though general practice seems to suggest otherwise. One well-known recipe book lists more than 100 different ways of serving potatoes. They may be steamed, baked, or boiled. They may be steamed over boiling water or under pressure. They may be boiled in water or meat stock or cooked in milk. They may have meat, cheese, or eggs added for flavouring and increased food value. If boiled or steamed, they may be mashed or creamed; they may be seasoned with butter or a nourishing sauce; they may be grated into a batter mixture and fried, and they

may be sauted in butter or fried in deep fat. Some appetising recipes are given here.

Fried Potatoes

French Fried Potatoes

Peel potatoes and cut lengthwise slices about ¼in. thick. Cut these slices again lengthwise into ¼in.-wide strips. Dry the cut surfaces between folds of a tea towel, then fry the slices in small lots in deep fat at 390 degrees F. until a golden colour (a 1in. cube of bread browns in 40 seconds at a temperature of 385 to 390 degrees F.). Drain on absorbent paper, sprinkle with salt, and serve hot. On standing, the pieces tend to lose their crispness.

Straw Potatoes

Straw potatoes are served with dishes such as roast turkey and chicken. Cut potatoes to the length and thickness of a match and fry similarly to French fried potatoes.

Saratoga Chips

Peel potatoes and shave crosswise into thin slices. (A potato peeler is excellent for this.) Soak the slices in cold water for an hour, drain, and dry on a towel. Fry in deep fat at about 390 degrees F. (a few at a time to prevent them sticking together) until golden brown. Drain on absorbent paper. The chips can be eaten hot or cold and will keep for a week or more, needing only to be made crisp in the oven before serving.

Saute Potatoes

1lb. of cold boiled potatoes	Chopped parsley
Salt and pepper	2oz. of butter or bacon dripping

Cut potatoes in rather thick slices and sprinkle with salt and pepper. Fry in hot fat, browning on both sides. Place on a hot dish, sprinkle with finely chopped parsley, and serve.

[*Sparrow*

Potatoes are best prepared by scrubbing them clean with a vegetable brush instead of peeling them and then cooking them in a steamer over boiling water.

Hashed Brown Potatoes

4 medium-sized cooked potatoes, chopped fine or sieved	2 tablespoons of milk
1½ tablespoons of flour	2 tablespoons of butter
	1 teaspoon of salt
	Pepper to taste

Heat butter in a frying pan, stir flour, pepper, and salt into the potato, and press down firmly into pan; add milk. Brown the potato slowly, allowing about 30 minutes for cooking. Turn it out as an omelet is turned and serve hot.

[*R. W. Orr*

One method of storing potatoes is in clamps similar to those used for parsnips in the illustration. The clamp at left is completed and that at right has the first layer of vegetables in position.

Baked Potato Recipes

Baked Potatoes

Select good baking potatoes of uniform size and shape, scrub thoroughly, and bake in a moderately hot oven (375 degrees F.) for 45 to 60 minutes or until soft when pressed. Take the potatoes from the oven at once, work gently with the fingers to loosen the skin, make a short gash to allow the steam to escape, season with butter, salt, and a dash of paprika and serve at once.

Stuffed Baked Potato

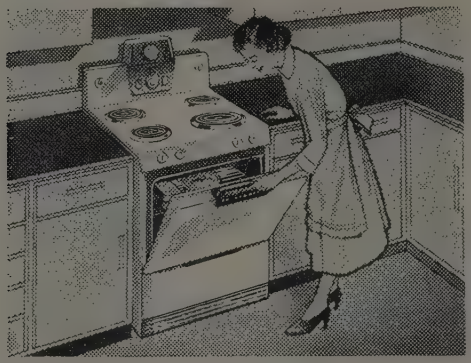
Cut baked potatoes in halves as soon as they are taken from the oven. Remove the insides, mash, and season with salt, pepper, and butter. Add enough hot milk to make them the consistency of mashed potatoes. Beat smooth and light. Refill the skins, dot with butter, and bake until browned in a hot oven (400 degrees F.) for 8 to 10 minutes.

Variations

1. To the mashed potatoes before the skins are filled add beaten egg white (1 egg white to 3 or 4 medium-sized potatoes).
2. Mix grated cheese (½ cup to 3 or 4 medium-sized potatoes) with the potato, reserving a small amount to sprinkle on the top of the potato after the jackets have been refilled.
3. Sprinkle chopped parsley on top of the stuffed potato.

Scalloped Potatoes (Raw)

Pare and slice potatoes thinly. Put in a buttered baking dish or casserole and sprinkle each layer very lightly with flour, salt and pepper, and a few dots of butter. Pour over the potatoes just enough milk to be seen through the top layer. Bake in a moderate oven (350 to 400 degrees F.) until the potatoes are tender (about 1 hour).



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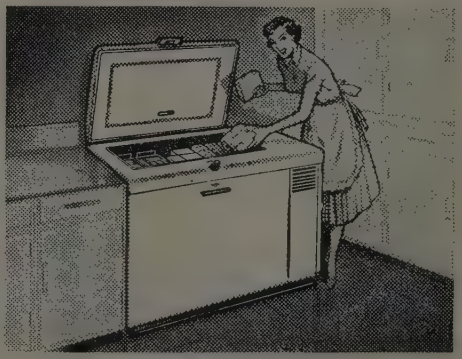

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Potatoes Baked in Milk

1lb. of potatoes
½ pint of milk
Salt and pepper
2oz. of butter

Choose small potatoes and boil and drain them. They should be tender but not breaking up. Butter a square baking dish and put potatoes in close together. Sprinkle with pepper and salt and pour the milk over them. The milk should not come more than half way up the potatoes. Put the remainder of the butter in small pieces on top of the potatoes and bake until brown (35 to 45 minutes) at 425 degrees F. (4 servings.)

Variation

Sprinkle the potatoes when almost cooked with 2oz. of finely grated cheese.

Various Dishes

Devilled Potatoes

1 dozen medium-sized new potatoes
2oz. of butter
1 teaspoon of made mustard
2 eggs (yolks only)
1 tablespoon of vinegar
½ teaspoon of salt
Shake of cayenne pepper

Put the potatoes on to boil and while they are cooking prepare the sauce. Melt the butter in a frying pan, add the mustard, vinegar, salt, and cayenne pepper and cook for a minute or two. When the potatoes are cooked peel them and add them with the well-beaten egg yolks to the sauce. Reheat, stirring to prevent sticking while the egg thickens. (4 to 6 servings.)

Potato Soup

1lb. of peeled potatoes
1 onion
2 or 3 sticks of celery
1oz. of butter
Pepper and salt
1 quart of stock
1 tablespoon of flour
½ pint of milk

Slice the potatoes, onion, and celery and fry in the melted butter for a few minutes without browning. Add the stock and seasoning and boil gently for 1½ hours. Rub the mixture through a sieve and return it to the saucepan. Mix the flour to a smooth cream with the milk. Add this thickening to the contents of the saucepan and stir until the soup boils. Serve hot. (4 to 6 servings.)

Potatoes baked in their jackets and garnished with parsley and paprika.

[*Sparrow*

Hard-boiled eggs covered with a well-flavoured sauce and sprinkled with cheese in a nest of mashed potatoes make this attractive bird nest pie.

Salads

Hot Potato Salad

2lb. of small white potatoes (unpeeled)
¼lb. of sliced bacon
¼lb. of frankfurters (sliced obliquely ¾in. thick)

Dressing

½ cup of minced onion
1½ teaspoons of flour
1 tablespoon of sugar
1½ teaspoons of salt
¼ teaspoon of pepper
¼ cup of vinegar
¼ cup of water

Addition to Dressing

¼ cup of minced onion
1 tablespoon of chopped parsley
1 teaspoon of celery seeds
4 hard-boiled eggs

Cook the potatoes in boiling salted water until tender. In the meantime saute the bacon in a frying pan until crisp and then remove on to absorbent paper. Fry the sliced frankfurters in the bacon fat until brown, then remove and keep hot while the dressing is being made in the frying pan. To make the dressing saute the ½ cup of minced onion in 2 tablespoons of bacon fat until tender but not brown, mix together the flour, sugar, salt, and pepper and add the vinegar and water. Stir until blended, then stir into the sauted onion and keep stirring while the mixture thickens. Into this dress-

Piping duchess potatoes. The plasticised cotton bag has a ring attachment on to which various nozzles may be screwed.

ing slice (about ¼in. thick) the hot peeled potatoes. Add the ½ cup of minced onion, parsley, and celery seeds. Mix the potatoes with the dressing.

Arrange in a salad bowl in order potato salad, frankfurters, and egg sliced lengthwise and on top scatter the chopped-up bacon. (6 servings.)

English Potato Salad

1½lb. of potatoes
1 tablespoon of chopped onion or chives
4 tablespoons of mayonnaise
2 teaspoons of chopped parsley

Boil the potatoes and drain and peel them. Cut into dice while still hot and stir into the mayonnaise with the parsley, chives or onion, and seasoning. Serve cold.

Mashed Potato Recipes

Mashed Potatoes

Steam as many potatoes as required. When they are cooked transfer to a saucepan and mash with a fork. Add salt and pepper and about 1oz. of butter and 2 tablespoons of hot milk to each pound of potatoes. Beat until smooth and stir over gentle heat until hot. Pile in a dish, smooth with a fork, garnish with a little chopped parsley, and serve hot.

Duchess Potatoes

2lb. of mashed potatoes
2oz. of butter
Salt and pepper
2 beaten egg yolks (1½ in potato, ½ for brushing over)
Hot milk

Stir the butter into the hot mashed potato, mix well, and add most of the beaten egg yolks, keeping out sufficient to brush over the potato before returning it to the oven. Add enough hot milk to make the mixture soft enough to be squeezed out of a forcing bag into rosettes or other shapes on to a greased baking sheet. Brush over with beaten egg and bake in a quick oven at 400 degrees F. until golden brown. (4 to 6 servings.)

Potato Aigrettes

½lb. of potatoes
2 eggs
1oz. of butter
Salt and pepper

Steam the potatoes and rub through a sieve. Add the butter and a good seasoning of salt and pepper. Whip the yolks and whites of the eggs separately. Beat the yolks into the mashed potato, then add the stiffly beaten whites. Drop a dessertspoonful into deep fat (385 degrees F.) and fry until golden brown.

Potato Souffle

Prepare as for aigrettes, but instead of frying put the mixture into a greased casserole and bake for 30 to 45 minutes at 300 degrees F. until golden brown and serve at once.

Bulletins for the Housekeeper

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Nos.

335 Cooking with Compressed Yeast.

350 Tomato Cookery.

368 Preparation of Dishes from Subtropical Fruits and Vegetables.

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Nos.

337 The Child and His Family. 6d.

338 Food and Health. 1s. 6d.

The above bulletins are available post free from the nearest office of the Department of Agriculture, or from the Head Office of the Department, Box 2298, Wellington.

Left-over Mashed Potato Dishes

Potato Pastry

1½lb. of left-over potato
1 tablespoon of milk
1oz. of flour
½ teaspoon of salt
1 egg

Warm the potato and rub through a sieve. Before it is quite cold add salt and flour. Mix well and add well-beaten egg yolk and milk. This is excellent for meat, fish, or vegetable pies, but the contents of the pie must be previously cooked. The pie should be cooked at a temperature of 425 degrees F.

Potato Scones

½lb. of cold potato
2oz. of butter
½ teaspoon of salt
4oz. of flour
1 teaspoon of baking powder
½ pint of milk
1 egg

Add the salt and baking powder to the flour and rub in the butter until evenly distributed. Rub the potatoes through a sieve and mix them with the flour. Beat the egg and stir it in, then add enough milk to make a rather soft but not sticky dough. Roll out on a floured board. Cut into rounds and bake in a moderate oven at 425 degrees F. Serve hot with butter.

Potato Girdle Cakes

1lb. of cooked potato
Flour
1 small teaspoon of salt

Warm the potato, rub it through a sieve, and add the salt. Turn on to a pastry board and when cool knead flour into it a spoonful at a time until the mixture is a smooth, even dough. The quantity varies according to the dryness of the potatoes, but the dough should be soft, though not soft enough to stick to the rolling pin. Roll out fairly thinly, cut into cakes, prick with a fork, and cook on a girdle, turning when brown on one side. Split through, butter, and serve hot.

Potato Croquettes

2 cups of mashed potato
2oz. of melted butter
1 teaspoon of chopped parsley
½ teaspoon of salt
1 small minced onion
1 egg (½ for croquettes, ½ for coating)
1 tablespoon of milk
Breadcrumbs
½ teaspoon of celery salt

Mix the potato, butter, parsley, salt, celery salt, onion, and ½ the egg well together and shape the mixture into cylinders. Dip these in fine breadcrumbs, then into the egg and milk mixture, and into breadcrumbs again. Leave for a short time to firm. Fry in hot fat at 385 degrees F. until golden colour (3 to 5 minutes). Serve hot with tomato sauce. (6 servings.)

Potato Omelet

1 breakfast cup of mashed potato
4 eggs
2 tablespoons of milk
Salt and pepper
1 teaspoon of finely chopped parsley
2oz. of bacon dripping or butter

Separate the whites and yolks of the eggs. Beat the yolks well and mix them with the mashed potato. Add the parsley, milk, and a seasoning of salt and pepper and mix thoroughly. Melt the dripping or butter in a pan. Whip the whites of the eggs until stiff and fold them into the potato mixture. Turn this into the pan and cook gently until brown underneath. Place for a minute or two under the grill to brown the top. Cooking time 5 to 10 minutes. Fold over and serve at once. (4 servings.)

A Classic Jersey with Long or Short Sleeves

THE classic jersey illustrated is of an attractive design for informal wear. Instructions are given which enable the knitter to produce a garment of a bust size of 40in. to 42in., 43in. to 45in., and 46in. to 48in.

ABBREVIATIONS: K., knit; p., purl; st., stitch(es); rep., repeat; dec., decrease; inc., increase; patt., pattern; cont., continue; in., inches; wl. fwd., wool forward; sl., slip; p.s.s.o., pass slipped stitch over; g.st., garter stitch (every row k.); beg., beginning; tog., together.

Materials: 7 (8, 8) oz. 3-ply wool for short sleeves; 9 (10, 10) oz. 3-ply wool for long sleeves; 2 No. 10 and 2 No. 12 knitting needles; 5 buttons.

Measurements

Small size: Bust, 40in. to 42in.; length, 21in.; sleeve, 5in. or 18in.

Medium size: Bust, 43in. to 45in.; length, 21½in.; sleeve, 5in. or 18in.

Large size: Bust, 46in. to 48in.; length, 22in.; sleeve, 5in. or 18in.

Tension: 7½ st. to 1in.

Follow first figure in brackets for medium size, second figure for large size. N.B.—It is advisable to work a sample of the pattern on 17 st. before beginning the garment.

The Back

With No. 12 needles cast on 119 (131-143) st. and work 3½in. in k. 1, p. 1 rib. Change to No. 10 needles and patt.:—

1st row: K. 1, * wl. fwd., sl. 1, k. 2 tog., p.s.s.o., wl. fwd., k. 3. Rep. from * to last 4 st., wl. fwd., sl. 1, k. 2 tog., p.s.s.o., wl. fwd., k. 1.

2nd row: P.

3rd row: K. 1, * K. 3, wl. fwd., sl. 1, k. 2 tog., p.s.s.o., wl. fwd. Rep. from * to last 4 st., k. 4.

4th row: P.

Cont. in patt., but inc. 1 st. at each end of next row and every foll. 6th row until there are 143 (155-167) st., taking the new st. into patt. as soon as there are 3 extra at each end. Cont. straight until work measures 12½in., ending with a p. row.

Shape armholes: Cast off 5 (5-9) at beg. of next 2 rows. Dec. 1 st. at each end of next 10 (10 to 12) rows, leaving 113 (125-125) st. Cont. straight until work measures 17½ (18-18½) in., ending with a 3rd patt. row.

Divide for Back Opening

Next row: Patt. 53, (59-59) st. and slip them on to a spare needle, then k. 7, patt. to end. Cont. on last set of st. only. Cont. ½in. straight, working the centre 7 st. in g.st., ending at inner edge. Make a buttonhole in next 2 rows, thus:—

Next row: K. 3, cast off 2, k. 2, patt. to end.

Next row: Patt. to last 5 st., k. 2, cast on 2, k. 3. Cont. straight, making 3 more buttonholes at intervals of 1in. Work 1 row straight after last buttonhole.

Shape shoulder: Cast off 10 (13-13) st. at beg. of next row. Work 1 row straight. Cast off 14 st. at beg. of next row and the following alternate row. Work 1 row straight. Slip remaining st. on to a spare needle for back neck. Return to st. on spare needle and with right side facing, join wool to inner end, cast on 7 st., k. 7, patt. to end. Keeping the inner 7 st. in g.st., cont. in patt. until this side is the same length as first side, ending at armhole edge.

Shape shoulder as for first side.

Front

With No. 12 needles cast on 131 (143-155) st. and work 3½in. in k. 1, p. 1 rib. Change to No. 10 needles and cont. in patt. as for back, but inc. 1 st. at each end of 5th row and every following 6th row until there are 161 (173-185) st. Cont. straight until work measures 13½in., ending with a p. row.

Shape armholes: Cast off 14 (14-18) st. at beg. of next 2 rows, dec. 1 st. at each end of next 10 (10 - 12) rows, leaving 113 (125-125) st. Cont. straight until work measures 19 (19½-20) in., ending with a p. row.

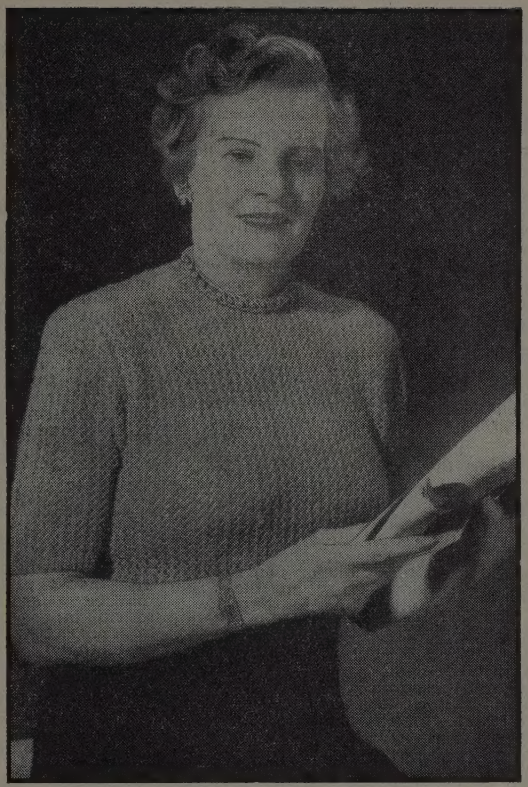
Shape neck: Next row: Patt. 48 (51-51) st., turn, leave remaining st. on a spare needle and cont. on last set of st. only. Dec. 1 st. at neck edge on next row and every following alternate row until 38 (41-41) st. remain. Cont. straight until work measures 22, (22½ to 23) in., ending at armhole edge.

Shape shoulder: Cast off 10 (13-13) st. at beg. of next row. Work 1 row straight. Cast off 14 st. at beg. of next row. Work 1 row and cast off. Return to st. on spare needle, slip the next 17 (23 to 23) st. on to st. holder for the present, join wool to inner edge and patt. to end. Shape neck and shoulder as for first side.

Long Sleeves

With No. 12 needles cast on 62 (62 to 68) st. and work 3in. in k. 1, p. 1 rib. Change to No. 10 needles and cont. in patt., but inc. 1 st. at each end of next row and every following 6th row until there are 104 (110-116) st. Cont. straight until work measures 18in., ending with a p/ row.

Shape top: Dec. 1 st. at beg. of every row until 46 st. remain. Cast off 3 st. at beg. of next 2 rows, and 4 st. at beg. of the following 4 rows. Cast off.



Short Sleeves

With No. 12 needles cast on 86 (92-98) st. and work 1in. in k. 1, p. 1 rib. Change to No. 10 needles and cont. in patt., but inc. 1 st. at each end of 1st row and every following 4th row until there are 104 (110-116) st. Cont. straight until work measures 5in., ending with a p. row. Shape top as for long sleeves.

Neck Ribbing

Join both shoulder seams. With right side of work facing, join wool to neck at top of left back edge and using No. 12 needles k. st. on spare needle, pick up and k. 35 st. along left front, k. the 17 (23 to 23) st. from st. holder, pick up and k. 35 st. along right front neck, and k. the st. on spare needle. Keeping the first and last 7 st. in g.st., work 5 rows in k. 1, p. 1 rib, then make a buttonhole as before in next 2 rows. Work 4 rows. Cast off in rib.

To Make up

Press work lightly on wrong side, using a hot iron and damp cloth. Sew in sleeves, put sleeve seam ½in. to the front, then sew up sleeve and side seams, easing in extra length of front about 2½in. below armholes. Slip stitch underwrap on wrong side to base of buttonhole border. Add buttons.

Pockets Increase Housework Apron's Usefulness

By EVELYN E. MOORE, Field Officer in Rural Sociology, Department of Agriculture, Palmerston North

MANY mothers who are constantly amazed at the number of articles their small sons manage to cram into their pockets may find that the pocket, as a hold-all, has its useful aspects as far as housework is concerned. The apron illustrated below can be made quickly from 1yd. of 36in. material such as gingham, denim, or any plain or plaid material which is the same on both sides, and its capacious pockets will be found most useful in the housewife's daily tasks.

BEFORE the apron is cut out straighten the end of the material by pulling a thread. The material should then be cut according to the diagram at the bottom of the page.

Making the Apron

The halter neck is completed using flat fell seams to join the two pieces together at A and to join the ends at B on to the top of the apron bib at B. The bottom edge of the apron is bound with bias tape or hemmed on the right side. It is then folded up along the dotted line C to make a pocket 8in. deep the full width of the skirt. The edges of the pocket are then bound with bias tape which is continued right round the outside edge of the apron. The pocket is then marked off into four sections. The two centre sections are made 9in. wide and the two outside ones 6in. wide. These are machine stitched in place and stayed at the top by extra stitching or binding. The inside neckline is then bound with bias tape and the apron ties are hemmed and stitched in place at D.

If the top pocket is desired, cut a piece 10in. x 5in. from the remnant and turn under and tack down the four sides. The top of the pocket may be hemmed or bound with bias tape. The pocket is then pinned and tacked in the position shown in the diagram and machined. It is divided in halves by another row of machine stitching and the top edges are stayed by extra stitching.

Uses for the Pockets

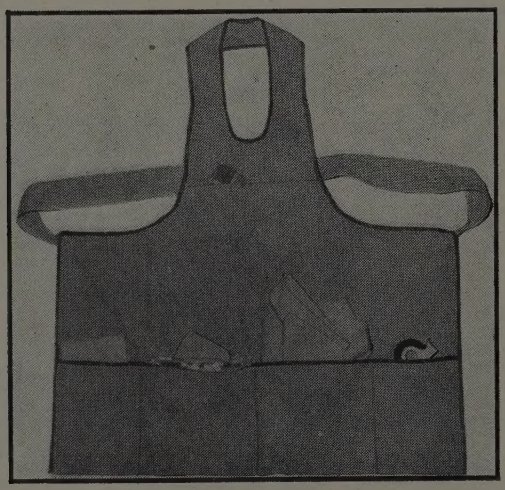
The four bottom pockets are useful for holding dusters, tins or bottles of polish, and small articles and toys left lying about which can be picked up while the room is being cleaned and put away afterwards. They are also useful for pegs and as a means of keeping spring clip or rubber pegs separate from the rest. The gardener will find them useful for odds and ends of string, ties, name sticks for plants and seedlings, seed packets, and clippers, and will find the apron sufficiently short so that it will not flap about or get in the way.

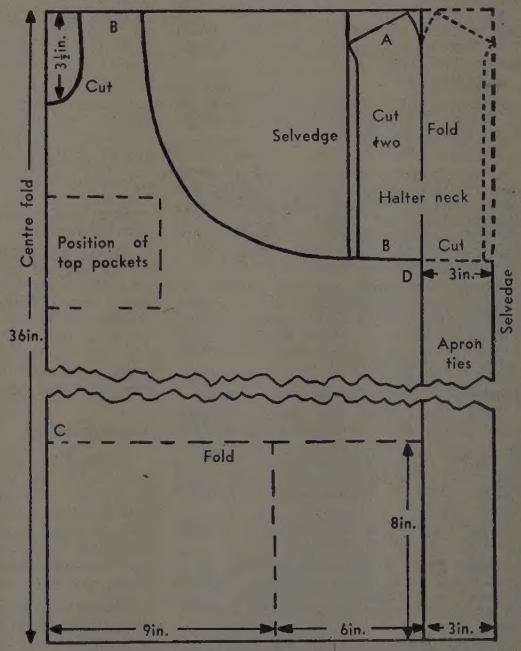
Waterproof Pocket

Mothers of young children who leave sticky fingermarks on doors, windows, walls, and furniture will find that a plastic lunch bag, which may be bought for a few pence, used as an inner pocket to one of the bottom pockets to hold a damp sponge or cloth will be very useful. In the course of a morning's cleaning its use may save several trips for a damp cloth to remove marks and further trips to return the cloth to the kitchen. It may also be very helpful during window cleaning.

If this inner pocket is inserted, it should be made so that it can be removed when the apron is washed or ironed, as ironing or very hot water will quickly melt the plastic. Domes may be sewn on tape machined to the turned-over top of the bag or may be carefully ironed into the plastic with a warm iron. To do this turn the top of the plastic bag back so that there are 4 layers at the top. Slip the dome of the fastener in between the layers in the middle of one side of the bag. Place the bag on any oddment of cotton cloth such as sheeting on top of the ironing blanket and cover it with another piece of similar material. Starting with a cool iron and taking care not to let the iron touch the plastic, iron gently over the top of the dome, inspecting it every few seconds to make sure that the plastic is not melting. As soon as the layers of plastic start to stick together sufficiently round the dome remove the iron, but do not pull the cloth away at once or a hole will be torn in the plastic. Wait until the plastic has cooled, when it can easily be pulled away from the cloth. The dome will be found to be embedded in the plastic, which has stuck together firmly, and the top of the dome can be worked gently through if a hole has not already been made. Too much heat will melt the plastic altogether and too little will cause it not to stick, so great care should be taken and a little practice on a spare strip cut from the top of the bag may be advisable.

The bag should then be domed in position in the centre pocket as shown in the illustration, that is, with the lip over the outside of the pocket so that the dome will not pull undone when anything is placed in the pocket.





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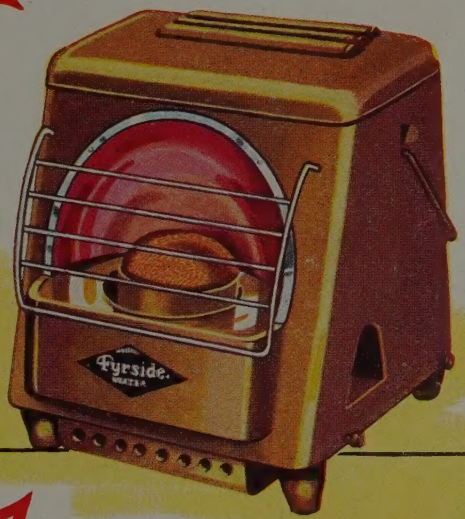

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